ELECTRIC CABLES

THEIR CONSTRUCTION & COST

COYLE & HOWE

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PREFACE

In view of the scarcity of published data relating to the manufacture and cost of electric cables, the Authors believe they will be placing in the hands of Electrical Engineers generally, a book that will be of the greatest utility in connection with all types of Light, Power and Telephone cable work.

The aim throughout the book has been to enable an engineer to determine the dimensions and approximate cost of any type of cable, by taking the component parts of the cable at the market price of the day, adding the items together with a percentage for labour and shop expenses.

The chapters are arranged according to the manufacturing processes, and details of the average English and Continental practice are given together with the recommendations of the various electrical institutions.

Conductors are treated exhaustively, and tables given based on square inch and square millimetre sections, and also Legal Standard, Birmingham, and Brown and Sharpe wire gauges.

The dielectric thickness required for any working pressure is considered in Chapter XIII., whilst numerous tables are given showing the thicknesses of dielectric for cables working at ordinary pressures.

Air Space Telephone Cable construction is fully considered in Chapter V.; the diameter of the cable being calculated direct from the electrostatic capacity required.

Tapes, Braids, Lead Sheath, Wire and Steel Tape armours are also fully considered.

The practical formulæ for the calculation of the various cable constants are given in Chapter XIII., and also various data obtained from tests on large numbers of actual cables.

A good deal of emphasis is given to the employment of the metric system generally, and it is hoped that the book will be more valuable on that account.

As this book is based on the Authors' many years (46 years in total) experience in some of the largest cable works in England and on the Continent, and represents the current practice, it is hoped that it will supply a long-felt want.

The recommendations of the Engineering Standards Committee, inserted in the various sections of the book, are extracted by their kind permission from Report No. 7, "British Standard Tables of Copper Conductors and Thicknesses of Dielectrics."

THE AUTHORS.

LONDON, 1909.

CONTENTS

ELECTRIC CABLES:

THEIR CONSTRUCTION AND COST.

CHAPTER I.

CONDUCTORS.

(A) Copper.

Cable conductors are at present almost exclusively constructed of copper, either a single wire or a strand of wires, according to the desired cross section of copper and the working conditions of the cable. For small cross sections, the strand may consist of 3 or 4 wires, but the usual strands are of 7, 19, 37, 61, 91 and 127 wires; these numbers form a series of the equation $3n(n+1)+1$ where n is any integer. The wires of these latter strands are laid up round a centre wire, the successive layers being formed of 6, 12, 18, 24 and 30 wires, which layers are generally applied with a left-handed and right-handed lay alternately.

Having decided upon the requisite cross section of the conductor, the weight of the copper and also the strands of wire, which form this cross section, can be seen from the following Tables, Nos. 1 and 2. When deciding upon the strand, it must be remembered that for rubber-insulated cables it is advisable not to use wires of greater diameter than 2·5 millimetres, owing to the strain which they would exert upon the rubber insulation when the cable is bent. For paper-insulated and other cables it is not advisable to use wires of greater diameter than 4·2 millimetres, on account of the lesser flexibility of cables constructed with wires of large diameter.

In the case of extra high tension cables, it is very important that curves of small radius be avoided in the periphery of the conductor; in some cases it may be advisable to provide the conductor with a circular metallic periphery, by encasing it in a thin tube of lead, or by lapping it with metallic foil.

Further, it may be economical to use conductors of lower conductivity than copper, such as aluminium, or even lay the copper wires round a dummy centre of jute packing; this will be considered fully in Chapter XIII.

The weights given in Tables Nos. 1 and 2 are based upon a specific gravity for copper of 8·912, that is to say, 1 kilometre of copper of 1000 square millimetre cross section weighs 8912 kilogrammes; therefore, 1 statute mile of copper of one square inch cross section weighs

$$\frac{8912 \times 645{\cdot}136 \times 1{\cdot}6093 \times 2{\cdot}2046}{1000} = 20{,}400 \text{ lb.}$$

The Engineering Standards Committee have recently recommended a basis of 555 lb. as the weight of one cubic foot of copper; therefore 1 statute mile of copper of one square inch cross section weighs

$$\frac{555 \times 1760 \times 3}{144} = 20{,}350 \text{ lb.}$$

The difference between these two bases is therefore less than $\frac{1}{4}$ per cent.

TABLE No. 1.—COPPER STRANDS.

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm²	Kilog. per km	lb. per mile	127	91	61	37	19	7
1·000	645·136	5750	20400	2·54	3·00	3·66	..	..	..
·999	644·570	5745	20380	2·54	3·00	3·66	..	..	..
·998	643·930	5739	20360	2·54	3·00	3·66	..	..	..
·997	643·300	5734	20338	2·53	3·00	3·66	..	..	..
·996	642·620	5728	20318	2·53	2·99	3·66	..	..	..
·995	642·000	5722	20298	2·53	2·99	3·66	..	..	..
·994	641·350	5716	20278	2·53	2·99	3·65	..	..	..
·993	640·720	5711	20257	2·53	2·99	3·65	..	..	..
·992	640·090	5705	20236	2·53	2·99	3·65	..	..	..
·991	639·440	5699	20216	2·53	2·99	3·65	..	..	..
·990	638·800	5693	20196	2·53	2·98	3·65	..	..	..
·989	638·150	5687	20175	2·53	2·98	3·64	..	..	..
·988	637·495	5681	20155	2·52	2·98	3·64	..	..	..
·987	636·844	5676	20134	2·52	2·98	3·64	..	..	..
·986	636·200	5670	20114	2·52	2·98	3·64	..	..	..
·985	635·550	5664	20093	2·52	2·98	3·64	..	..	..
·984	634·910	5658	20073	2·52	2·98	3·64	..	..	..
·983	634·270	5652	20053	2·52	2·97	3·63	..	..	..
·982	633·610	5647	20033	2·51	2·97	3·63	..	..	..
·981	632·970	5641	20012	2·51	2·97	3·63	..	..	..
·980	632·320	5635	19992	2·51	2·97	3·63	..	..	..
·979	631·680	5629	19972	2·51	2·97	3·63	..	..	..
·978	631·030	5625	19952	2·51	2·97	3·62	..	..	..
·977	630·360	5619	19932	2·51	2·96	3·62	..	..	..
·976	629·710	5613	19911	2·51	2·96	3·62	..	..	..
·975	629·090	5607	19890	2·51	2·96	3·62	..	..	..
·974	628·410	5601	19870	2·50	2·96	3·62	..	..	..
·973	627·780	5595	19850	2·50	2·96	3·61	..	..	..
·972	627·130	5589	19830	2·50	2·96	3·61	..	..	..
·971	626·505	5584	19809	2·50	2·96	3·61	..	..	..
·970	625·830	5578	19788	2·50	2·95	3·61	..	..	..
·969	625·160	5572	19768	2·50	2·95	3·61	..	..	..
·968	624·520	5566	19747	2·50	2·95	3·61	..	..	..
·967	623·870	5560	19727	2·50	2·95	3·60	..	..	..
·966	623·220	5555	19707	2·49	2·95	3·60	..	..	..
·965	622·590	5548	19686	2·49	2·95	3·60	..	..	..
·964	621·950	5543	19666	2·49	2·95	3·60	..	..	..
·963	621·290	5537	19646	2·49	2·94	3·60	..	..	..
·962	620·650	5532	19624	2·49	2·94	3·59	..	..	..
·961	620·000	5526	19604	2·49	2·94	3·59	..	..	..
·960	619·380	5520	19584	2·49	2·94	3·59	..	..	..
·959	618·720	5514	19564	2·49	2·94	3·59	..	..	..
·958	618·090	5508	19543	2·48	2·94	3·59	..	..	..
·957	617·470	5503	19523	2·48	2·93	3·58	..	..	..
·956	616·800	5497	19503	2·48	2·93	3·58	..	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·955	616·17	5492	19482	2·48	2·93	3·58	..	..	..
·954	615·52	5486	19462	2·48	2·93	3·58	..	..	..
·953	614·87	5480	19441	2·48	2·93	3 58	..	..	.
·952	614·25	5474	19421	2·48	2·93	3·58	..	..	..
·951	613·60	5468	19400	2·48	2·93	3·57	..	..	..
·950	612·96	5463	19380	2·47	2·92	3·57	..	..	..
·949	612·30	5457	19360	2·47	2·92	3·57	..	..	..
·948	611·65	5451	19339	2·47	2·92	3·57	..	..	..
·947	611·00	5445	19319	2·47	2·92	3·57	..	..	..
·946	610·38	5439	19299	2·47	2·92	3·56	..	..	..
·945	609·73	5434	19278	2·47	2·92	3·56	..	..	..
·944	609·10	5428	19258	2·47	2·91	3·56	..	..	..
·943	608·48	5423	19237	2·46	2·91	3·56	..	..	..
·942	607·80	5417	19217	2·46	2·91	3·56	..	..	..
·941	607·15	5411	19196	2·46	2·91	3·56	..	..	..
·940	606·53	5405	19176	2·46	2·91	3·55	..	..	..
·939	605·90	5400	19156	2·46	2·91	3·55	..	..	..
·938	605·26	5394	19136	2·46	2·91	3·55	..	..	..
·937	604·58	5388	19115	2·46	2·90	3·55	..	..	..
·936	603·94	5383	19095	2·45	2·90	3·55	..	..	..
·935	603·28	5377	19074	2·45	2·90	3·54	..	..	..
·934	602·62	5371	19054	2·45	2·90	3·54	..	..	..
·933	602·00	5365	19034	2·45	2·90	3·54	..	..	..
·932	601·34	5359	19013	2·45	2·90	3·54	..	..	..
·931	600·72	5354	18993	2·45	2·89	3·54	..	..	..
·930	600·04	5348	18973	2·45	2·89	3·54	..	..	..
·929	599·40	5342	18952	2·45	2·89	3·53	..	..	..
·928	598·78	5337	18932	2·44	2·89	3·53	..	..	..
·927	598·12	5331	18911	2·44	2·89	3·53	..	..	..
·926	597·46	5325	18891	2·44	2·89	3·53	..	..	..
·925	596·80	5319	18870	2·44	2·88	3·52	..	..	..
·924	596·14	5313	18850	2·44	2·88	3·52	..	..	..
·923	595·53	5308	18830	2·44	2·88	3·52	..	..	..
·922	594·88	5302	18809	2·44	2·88	3·52	..	..	..
·921	594·22	5296	18789	2·44	2·88	3·52	..	..	..
·920	593·58	5290	18768	2·43	2·88	3·52	..	..	..
·919	592·95	5284	18748	2·43	2·88	3·51	..	..	..
·918	592·30	5279	18727	2·43	2·87	3·51	..	..	..
·917	591·64	5273	18707	2·43	2·87	3·51	..	..	..
·916	591·00	5267	18686	2·43	2·87	3·51	..	..	..
·915	590·35	5262	18665	2·43	2·87	3·51	..	..	..
·914	589·70	5256	18645	2·43	2·87	3·50	..	..	..
·913	589·08	5250	18624	2·43	2·87	3·50	..	..	..
·912	588·44	5244	18604	2·42	2·86	3·50	..	..	..
·911	587·78	5238	18583	2·42	2·86	3·50	..	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·910	587·15	5233	18563	2·42	2·86	3·50	..	..	..
·909	586·50	5227	18542	2·42	2·86	3·49	..	..	..
·908	585·87	5222	18522	2·42	2·86	3·49	..	..	..
·907	585·23	5216	18501	2·42	2·86	3·49	..	..	..
·906	584·60	5211	18481	2·42	2·86	3·49	..	..	..
·905	583·95	5205	18461	2·41	2·85	3·49	..	..	..
·904	583·32	5199	18440	2·41	2·85	3·49	..	..	..
·903	582·68	5193	18420	2·41	2·85	3·48	..	..	..
·902	582·04	5188	18400	2·41	2·85	3·48	..	..	..
·901	581·39	5182	18380	2·41	2·85	3·48	..	..	..
·900	580·74	5176	18360	2·41	2·85	3·48	..	..	..
·899	580·10	5170	18339	2·41	2·84	3·47	..	..	..
·898	579·45	5165	18319	2·40	2·84	3·47	..	..	..
·897	578·80	5159	18299	2·40	2·84	3·47	..	..	..
·896	578·15	5153	18278	2·40	2·84	3·47	..	..	..
·895	577·50	5147	18258	2·40	2·84	3·47	..	..	..
·894	576·86	5142	18238	2·40	2·84	3·47	..	..	..
·893	576·23	5136	18218	2·40	2·83	3·46	..	..	..
·892	575·57	5130	18197	2·40	2·83	3·46	..	..	..
·891	574·90	5124	18177	2·40	2·83	3·46	..	..	..
·890	574·25	5118	18157	2·39	2·83	3·46	..	..	..
·889	573·60	5113	18137	2·39	2·83	3·46	..	..	..
·888	572·97	5107	18116	2·39	2·83	3·45	..	..	..
·887	572·33	5102	18095	2·39	2·82	3·45	..	..	..
·886	571·67	5096	18075	2·39	2·82	3·45	..	..	..
·885	571·04	5090	18054	2·39	2·82	3·45	..	..	..
·884	570·38	5084	18034	2·39	2·82	3·45	..	..	..
·883	569·74	5078	18013	2·38	2·82	3·44	..	..	..
·882	569·08	5072	17993	2·38	2·82	3·44	..	..	..
·881	568·44	5067	17972	2·38	2·82	3·44	..	..	..
·880	567·78	5061	17952	2·38	2·81	3·44	..	..	..
·879	567·15	5055	17931	2·38	2·81	3·44	..	..	..
·878	566·50	5049	17911	2·38	2·81	3·43	..	..	..
·877	565·87	5044	17891	2·38	2·81	3·43	..	..	..
·876	565·22	5038	17870	2·38	2·81	3·43	..	..	..
·875	564·58	5033	17850	2·37	2·81	3·43	..	..	..
·874	563·93	5027	17830	2·37	2·80	3·43	..	..	..
·873	563·30	5021	17809	2·37	2·80	3·42	..	..	..
·872	562·66	5015	17789	2·37	2·80	3·42	..	..	..
·871	562·00	5009	17768	2·37	2·80	3·42	..	..	..
·870	561·35	5004	17748	2·37	2·80	3·42	..	..	..
·869	560·72	4998	17727	2·36	2·80	3·42	..	..	..
·868	560·08	4992	17707	2·36	2·79	3·41	..	..	..
·867	559·43	4986	17687	2·36	2·79	3·41	..	..	..
·866	558·80	4981	17666	2·36	2·79	3·41	..	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·865	558·15	4975	17646	2·36	2·79	3·41	..	..	..
·864	557·50	4969	17626	2·36	2·79	3·41	..	..	..
·863	556·86	4963	17605	2·36	2·79	3·40	..	..	..
·862	556·22	4958	17585	2·36	2·78	3·40	..	..	..
·861	555·60	4952	17564	2·35	2·78	3·40	..	..	..
·860	554·94	4946	17544	2·35	2·78	3·40	..	..	..
·859	554·28	4940	17523	2·35	2·78	3·40	..	..	..
·858	553·62	4935	17503	2·35	2·78	3·39	..	..	..
·857	553·00	4929	17482	2·35	2·78	3·39	..	..	..
·856	552·36	4923	17462	2·35	2·78	3·39	..	..	..
·855	551·70	4917	17442	2·35	2·77	3·39	..	..	..
·854	551·05	4912	17422	2·34	2·77	3·39	..	..	..
·853	550·40	4906	17402	2·34	2·77	3·38	..	..	..
·852	549·75	4900	17381	2·34	2·77	3·38	..	..	..
·851	549·08	4894	17361	2·34	2·77	3·38	..	..	..
·850	548·45	4889	17340	2·34	2·77	3·38	..	..	..
·849	547·80	4883	17320	2·34	2·76	3·38	..	..	..
·848	547·18	4877	17300	2·34	2·76	3·37	..	..	..
·847	546·52	4871	17279	2·34	2·76	3·37	..	..	..
·846	545·86	4865	17259	2·33	2·76	3·37	..	..	..
·845	545·22	4859	17238	2·33	2·76	3·37	..	..	..
·844	544·56	4854	17218	2·33	2·76	3·37	..	..	..
·843	543·94	4848	17198	2·33	2·75	3·36	..	..	..
·842	543·27	4842	17177	2·33	2·75	3·36	..	..	..
·841	542·63	4836	17157	2·33	2·75	3·36	..	..	..
·840	541·98	4830	17136	2·33	2·75	3·36	..	..	..
·839	541·34	4825	17116	2·32	2·75	3·36	..	..	..
·838	540·70	4819	17095	2·32	2·75	3·35	..	..	..
·837	540·05	4813	17075	2·32	2·74	3·35	..	..	..
·836	539·43	4807	17054	2·32	2·74	3·35	..	..	..
·835	538·76	4801	17035	2·32	2·74	3·35	..	..	..
·834	538·12	4796	17013	2·32	2·74	3·35	..	..	..
·833	537·47	4790	16993	2·32	2·74	3·34	..	..	..
·832	536·83	4784	16972	2·32	2·74	3·34	..	..	..
·831	536·20	4779	16952	2·31	2·73	3·34	..	..	..
·830	535·55	4773	16932	2·31	2·73	3·34	..	..	..
·829	534·90	4767	16911	2·31	2·73	3·34	..	..	..
·828	534·25	4761	16891	2·31	2·73	3·33	..	..	..
·827	533·60	4755	16870	2·31	2·73	3·33	..	..	..
·826	533·00	4750	16850	2·31	2·73	3·33	..	..	..
·825	532·34	4744	16830	2·30	2·72	3·33	..	..	..
·824	531·70	4738	16810	2·30	2·72	3·33	..	..	..
·823	531·04	4733	16789	2·30	2·72	3·32	..	..	..
·822	530·40	4727	16769	2·30	2·72	3·32	..	..	..
·821	529·75	4721	16748	2·30	2·72	3·32	..	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0 820	529·12	4715	16728	2·30	2·72	3·32	..	..	..
·819	528·46	4710	16707	2·30	2·71	3·32	..	..	..
·818	527·82	4704	16687	2·30	2·71	3·31	..	..	..
·817	527·18	4698	16667	2·29	2·71	3·31	..	..	..
·816	526·53	4693	16646	2·29	2·71	3·31	..	..	..
·815	525·88	4687	16626	2·29	2·71	3·31	..	..	..
·814	525·22	4681	16606	2·29	2·71	3·31	..	..	..
·813	524·58	4675	16585	2·29	2·70	3·30	..	..	..
·812	523·92	4670	16565	2·29	2·70	3·30	..	..	..
·811	523·28	4664	16544	2·29	2·70	3·30	..	..	..
·810	522·64	4658	16524	2·28	2·70	3·30	..	..	..
·809	521·99	4652	16504	2·28	2·70	3·30	..	..	..
·808	521·33	4647	16483	2·28	2·70	3·29	..	..	..
·807	520·69	4641	16463	2·28	2·69	3·29	..	..	..
·806	520·03	4635	16443	2·28	2·69	3·29	..	..	..
·805	519·38	4629	16422	2·28	2·69	3·29	..	..	..
·804	518·73	4623	16402	2·28	2·69	3·29	..	..	..
·803	518·10	4618	16381	2·27	2·69	3·28	..	..	..
·802	517·47	4612	16361	2·27	2·69	3·28	4·21	..	..
·801	516·80	4606	16340	2·27	2·68	3·28	4·21	..	..
·800	516·18	4601	16320	2·27	2·68	3·28	4·21	..	..
·799	515·52	4595	16300	2·27	2·68	3·28	4·21	..	..
·798	514·89	4589	16280	2·27	2·68	3·27	4·20	..	..
·797	514·23	4583	16259	2·27	2·68	3·27	4·20	..	..
·796	513·58	4578	16239	2·26	2·68	3·27	4·20	..	..
·795	512·96	4572	16218	2·26	2·67	3·27	4·20	..	..
·794	512·23	4566	16198	2·26	2·67	3·27	4·19	..	..
·793	511·67	4561	16177	2·26	2·67	3·27	4·19	..	..
·792	511·03	4555	16157	2·26	2·67	3·26	4·19	..	..
·791	510·38	4549	16136	2·26	2·67	3·26	4·19	..	..
·790	509·73	4543	16116	2·26	2·67	3·26	4·18	..	..
·789	509·08	4537	16096	2·25	2·66	3·26	4·18	..	..
·788	508·45	4532	16075	2·25	2·66	3·25	4·18	..	..
·787	507·80	4526	16055	2·25	2·66	3·25	4·17	..	..
·786	507·16	4520	16034	2·25	2·66	3·25	4·17	..	..
·785	506·52	4515	16014	2·25	2·66	3·25	4·17	..	..
·784	505·89	4509	15993	2·25	2·66	3·24	4·17	..	..
·783	505·22	4503	15973	2·25	2·66	3·24	4·16	..	..
·782	504·58	4497	15953	2·24	2·65	3·24	4·16	..	..
·781	503·94	4492	15933	2·24	2·65	3·24	4·16	..	..
·780	503·28	4486	15913	2·24	2·65	3·24	4·16	..	..
·779	502·63	4480	15892	2·24	2·65	3·23	4·15	..	..
·778	502·00	4474	15872	2·24	2·65	3·23	4·15	..	..
·777	501·35	4468	15851	2·24	2·64	3·23	4·15	..	..
·776	500·70	4463	15831	2·24	2·64	3·23	4·15	..	..

TABLE NO. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·775	500·04	4457	15810	2·23	2·64	3·23	4·14	..	..
·774	499·40	4451	15790	2·23	2·64	3·22	4·14	..	..
·773	498·76	4445	15770	2·23	2·64	3·22	4·14	..	..
·772	498·12	4440	15750	2·23	2·64	3·22	4·13	..	..
·771	497·48	4434	15729	2·23	2·63	3·22	4·13	..	..
·770	496·83	4428	15709	2·23	2·63	3·22	4·13	..	..
·769	496·17	4422	15689	2·23	2·63	3·21	4·13	..	..
·768	495·52	4417	15668	2·22	2·63	3·21	4·12	..	..
·767	494·87	4411	15648	2·22	2·63	3·21	4·12	..	..
·766	494·22	4405	15628	2·22	2·62	3·21	4·12	..	..
·765	493·57	4399	15607	2·22	2·62	3·21	4·12	..	..
·764	492·93	4393	15587	2·22	2·62	3·20	4·11	..	..
·763	492·30	4388	15566	2·22	2·62	3·20	4·11	..	..
·762	491·65	4382	15546	2·21	2·62	3·20	4·11	..	..
·761	491·00	4376	15525	2·21	2·62	3·20	4·11	..	..
·760	490·35	4370	15505	2·21	2·61	3·19	4·10	..	..
·759	489·70	4365	15484	2·21	2·61	3·19	4·10	..	..
·758	489·07	4359	15464	2·21	2·61	3·19	4·10	..	..
·757	488·42	4353	15443	2·21	2·61	3·19	4·09	..	..
·756	487·80	4348	15423	2·21	2·61	3·19	4·09	..	..
·755	487·16	4342	15402	2·20	2·61	3·18	4·09	..	..
·754	486·50	4336	15382	2·20	2·60	3·18	4·09	..	..
·753	485·86	4330	15361	2·20	2·60	3·18	4·08	..	..
·752	485·23	4324	15341	2·20	2·60	3·18	4·08	..	..
·751	484·59	4318	15320	2·20	2·60	3·18	4·08	..	..
·750	483·95	4313	15300	2·20	2·60	3·17	4·08	..	..
·749	483·30	4307	15279	2·20	2·60	3·17	4·07	..	..
·748	482·65	4301	15259	2·19	2·59	3·17	4·07	..	..
·747	482·00	4295	15238	2·19	2·59	3·17	4·07	..	..
·746	481·37	4290	15218	2·19	2·59	3·17	4·06	..	..
·745	480·73	4284	15198	2·19	2·59	3·16	4·06	..	..
·744	480·08	4278	15178	2·19	2·59	3·16	4·06	..	..
·743	479·44	4273	15157	2·19	2·58	3·16	4·06	..	..
·742	478·76	4267	15137	2·19	2·58	3·16	4·05	..	..
·741	478·12	4261	15117	2·18	2·58	3·15	4·05	..	..
·740	477·48	4255	15097	2·18	2·58	3·15	4·05	..	..
·739	476·83	4249	15076	2·18	2·58	3·15	4·05	..	..
·738	476·17	4244	15056	2·18	2·58	3·15	4·04	..	..
·737	475·53	4238	15035	2·18	2·57	3·15	4·04	..	..
·736	474·90	4232	15015	2·18	2·57	3·14	4·04	..	..
·735	474·24	4227	14994	2·18	2·57	3·14	4·04	..	..
·734	473·58	4221	14974	2·17	2·57	3·14	4·03	..	..
·733	472·93	4215	14954	2·17	2·57	3·14	4·03	..	..
·732	472·30	4209	14933	2·17	2·57	3·14	4·03	..	..
·731	471·65	4203	14913	2·17	2·56	3·13	4·02	..	..

TABLE NO. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·730	471·00	4198	14893	2·17	2·56	3·13	4·02	..	..
·729	470·36	4192	14872	2·17	2·56	3·13	4·02	..	..
·728	469·73	4186	14852	2·16	2·56	3·13	4·02	..	..
·727	469·08	4180	14831	2·16	2·56	3·12	4·01	..	..
·726	468·42	4175	14811	2·16	2·56	3·12	4·01	..	..
·725	467·78	4169	14790	2·16	2·55	3·12	4·01	..	..
·724	467·14	4163	14770	2·16	2·55	3·12	4·00	..	..
·723	466·50	4157	14749	2·16	2·55	3·12	4·00	..	..
·722	465·85	4152	14729	2·16	2·55	3·11	4·00	..	..
·721	465·22	4146	14708	2·15	2·55	3·11	4·00	..	..
·720	464·58	4140	14688	2·15	2·54	3·11	3·99	..	..
·719	463·92	4134	14668	2·15	2·54	3·11	3·99	..	..
·718	463·28	4129	14647	2·15	2·54	3·10	3·99	..	..
·717	462·62	4123	14627	2·15	2·54	3·10	3·98	..	..
·716	462·00	4117	14607	2·15	2·54	3·10	3·98	..	..
·715	461·35	4111	14586	2·15	2·54	3·10	3·98	..	..
·714	460·70	4106	14566	2·14	2·53	3·10	3·98	..	..
·713	460·06	4100	14545	2·14	2·53	3·09	3·97	..	..
·712	459·40	4094	14525	2·14	2·53	3·09	3·97	..	..
·711	458·77	4088	14504	2·14	2·53	3·09	3·97	..	..
·710	458·12	4083	14484	2·14	2·53	3·09	3·97	..	..
·709	457·47	4077	14464	2·14	2·52	3·09	3·96	..	..
·708	456·82	4071	14444	2·14	2·52	3·08	3·96	..	..
·707	456·17	4065	14423	2·13	2·52	3·08	3·96	..	..
·706	455·50	4059	14403	2·13	2·52	3·08	3·95	..	..
·705	454·88	4054	14383	2·13	2·52	3.08	3·95	..	..
·704	454·23	4048	14362	2·13	2·52	3·07	3·95	..	..
·703	453·58	4042	14342	2·13	2·51	3·07	3·95	..	..
·702	452·93	4037	14322	2·13	2·51	3·07	3·94	..	..
·701	452·28	4031	14301	2·12	2·51	3·07	3·94	..	..
·700	451·65	4025	14281	2·12	2·51	3·07	3·94	..	..
·699	451·00	4019	14260	2·12	2·51	3·06	3·93	..	..
·698	450·37	4014	14240	2·12	2·51	3·06	3·93	..	..
·697	449·72	4008	14220	2·12	2·50	3·06	3·93	..	..
·696	449·06	4002	14199	2·12	2·50	3·06	3·93	..	..
·695	448·42	3996	14179	2·12	2·50	3·05	3·92	..	..
·694	447·80	3991	14158	2·11	2·50	3·05	3·92	..	..
·693	447·14	3985	14138	2·11	2·50	3·05	3·92	..	..
·692	446·50	3979	14118	2·11	2·49	3·05	3·91	..	..
·691	445·85	3973	14097	2·11	2·49	3·05	3·91	..	..
·690	445·20	3968	14077	2·11	2·49	3·04	3·91	..	..
·689	444·57	3962	14056	2·11	2·49	3·04	3·91	..	..
·688	443·92	3956	14036	2·10	2·49	3·04	3·90	..	..
·687	443·28	3950	14016	2·10	2·49	3·04	3·90	..	..
·686	442·63	3945	13995	2·10	2·48	3·03	3·90	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.^{2}	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·685	442·00	3939	13975	2·10	2·48	3·03	3·89	..	..
·684	441·35	3933	13954	2·10	2·48	3·03	3·89	..	..
·683	440·70	3927	13934	2·10	2·48	3·03	3·89	..	..
·682	440·07	3922	13913	2·10	2·48	3·03	3·89	..	..
·681	439·42	3916	13893	2·09	2·47	3·02	3·88	..	..
·680	438·75	3910	13872	2·09	2·47	3·02	3·88	..	..
·679	438·10	3904	13852	2·09	2·47	2·02	3·88	..	..
·678	437·48	3899	13832	2·09	2·47	3·02	3·87	..	..
·677	436·82	3893	13812	2·09	2·47	3·01	3·87	..	..
·676	436·17	3887	13791	2·09	2·47	3·01	3·87	..	..
·675	435·52	3881	13771	2·08	2·46	3·01	3·87	..	..
·674	434·88	3875	13751	2·08	2·46	3·01	3·86	..	..
·673	434·22	3870	13730	2·08	2·46	3·01	3·86	..	..
·672	433·58	3864	13710	2·08	2·46	3·00	3·86	..	..
·671	432·94	3858	13689	2·08	2·46	3·00	3·85	..	..
·670	432·30	3853	13669	2·08	2·45	3·00	3·85	..	..
·669	431·63	3847	13648	2·08	2·45	3·00	3·85	..	..
·668	431·00	3841	13628	2·07	2·45	2·99	3·85	..	..
·667	430·35	3835	13608	2·07	2·45	2·99	3·84	..	..
·666	429·72	3829	13587	2·07	2·45	2·99	3·84	..	..
·665	429·07	3824	13567	2·07	2·45	2·99	3·84	..	..
·664	428·43	3818	13546	2·07	2·44	2·99	3·83	..	..
·663	427·80	3812	13526	2·07	2·44	2·98	3·83	..	..
·662	427·14	3807	13505	2·06	2·44	2·98	3·83	..	..
·661	426·48	3801	13485	2·06	2·44	2·98	3·83	..	..
·660	425·85	3795	13465	2·06	2·44	2·98	3·82	..	..
·659	425·20	3789	13444	2·06	2·43	2·97	3·82	..	..
·658	424·57	3784	13424	2·06	2·43	2·97	3·82	..	..
·657	423·92	3778	13403	2·06	2·43	2·97	3·81	..	..
·656	423·28	3772	13383	2·05	2·43	2·97	3·81	..	..
·655	422·62	3766	13362	2 05	2·43	2·97	3·81	..	..
·654	422·00	3761	13342	2·05	2·43	2·96	3·81	..	..
·653	421·34	3755	13322	2·05	2·42	2·96	3·80	..	..
·652	420·69	3749	13301	2·05	2·42	2·96	3·80	..	..
·651	420·05	3743	13281	2·05	2·42	2·96	3·80	..	..
·650	419·40	3738	13260	2·05	2·42	2·95	3·79	..	..
·649	418·76	3732	13240	2·04	2·42	2·95	3·79	..	..
·648	418·12	3726	13219	2·04	2·41	2·95	3·79	..	..
·647	417·47	3721	13199	2·04	2·41	2·95	3·79	..	..
·646	416·82	3715	13179	2·04	2·41	2·95	3·78	..	..
·645	416·18	3709	13158	2·04	2·41	2·94	3·78	..	..
·644	415·52	3703	13138	2·04	2·41	2·94	3·78	..	..
·643	414·88	3697	13118	2·03	2·40	2·94	3·77	..	..
·642	414·23	3692	13097	2·03	2·40	2·94	3·77	..	..
·641	413·58	3686	13077	2·03	2·40	2·93	3·77	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·640	412·93	3680	13057	2·03	2·40	2·93	3·76	..	..
·639	412·28	3674	13036	2·03	2·40	2·93	3·76	..	..
·638	411·65	3669	13016	2·03	2·40	2·93	3·76	..	..
·637	411·00	3663	12995	2·02	2·39	2·92	3·76	..	..
·636	410·36	3657	12975	2·02	2·39	2·92	3·75	..	..
·635	409·72	3651	12954	2·02	2·39	2·92	3·75	..	..
·634	409·08	3646	12934	2·02	2·39	2·92	3·75	..	..
·633	408·42	3640	12914	2·02	2·39	2·92	3·74	..	..
·632	407·78	3634	12893	2·02	2·38	2·91	3·74	..	..
·631	407·14	3628	12873	2·02	2·38	2·91	3·74	..	..
·630	406·50	3623	12853	2·01	2·38	2·91	3·73	..	..
·629	405·86	3617	12832	2·01	2·38	2·91	3·73	..	..
·628	405·20	3611	12812	2·01	2·38	2·90	3·73	..	..
·627	404·56	3605	12791	2·01	2·37	2·90	3·73	..	..
·626	403·92	3599	12771	2·01	2·37	2·90	3·72	..	..
·625	403·28	3594	12750	2·01	2·37	2·90	3·72	..	..
·624	402·64	3588	12730	2·00	2·37	2·89	3·72	..	..
·623	402·00	3582	12709	2·00	2·37	2·89	3·71	..	..
·622	401·35	3577	12689	2·00	2·36	2·89	3·71	..	..
·621	400·70	3571	12669	2·00	2·36	2·89	3·71	..	..
·620	400·05	3565	12648	2·00	2·36	2·88	3·71	..	..
·619	399·40	3559	12628	2·00	2·36	2·88	3·70	..	..
·618	398·75	3553	12608	1·99	2·36	2·88	3·70	..	..
·617	398·10	3548	12587	1·99	2·36	2·88	3·70	..	..
·616	397·46	3542	12567	1·99	2·35	2·88	3·69	..	..
·615	396·80	3536	12547	1·99	2·35	2·87	3·69	..	..
·614	396·18	3530	12526	1·99	2·35	2·87	3 69	..	..
·613	395·52	3525	12506	1·99	2·35	2·87	3·68	..	..
·612	394·88	3519	12486	1·98	2·35	2·87	3·68	..	..
·611	394·24	3513	12465	1·98	2·34	2·86	3·68	..	..
·610	393·58	3507	12445	1·98	2·34	2·86	3·68	.	.
·609	392·95	3502	12425	1·98	2·34	2·86	3·67	..	..
·608	392·30	3496	12404	1·98	2·34	2·86	3·67	..	..
·607	391·66	3490	12384	1·98	2·34	2·85	3·67	..	..
·606	391·00	3484	12363	1·97	2·33	2·85	3·66	..	..
·605	390·38	3479	12343	1·97	2·33	2·85	3·66	..	..
·604	389·72	3473	12323	1·97	2·33	2·85	3·66	..	..
·603	389·08	3467	12302	1·97	2·33	2·85	3·65	..	..
·602	388·47	3462	12282	1·97	2·33	2·84	3·65	..	..
·601	387·80	3456	12261	1·97	2·32	2·84	3·65	..	..
·600	387·15	3450	12241	1·96	2·32	2·84	3·64	..	..
·599	386·50	3444	12220	1·96	2·32	2·84	3·64	..	..
·598	385·87	3439	12200	1·96	2·32	2·83	3·64	..	..
·597	385·22	3433	12179	1·96	2·32	2·83	3 64	..	..
·596	384·56	3427	12159	1·96	2·31	2·83	3·64	..	..
·595	383·92	3421	12138	1·96	2·31	8·83	3·63	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·594	383·28	3416	12118	1·95	2·31	2·82	3·63	. .	. .
·593	382·62	3410	12098	1·95	2·31	2·82	3·62	. .	. .
·592	382·00	3404	12077	1·95	2·31	2·82	3·62	. .	. .
·591	381·34	3398	12057	1·95	2·31	2·82	3·62	. .	. .
·590	380·70	3393	12037	1·95	2·30	2·81	3·61	.	. .
·589	380·06	3387	12016	1·95	2·30	2·81	3·61	. .	. .
·588	379·40	3381	11996	1·95	2·30	2·81	3·61	. .	. .
·587	378·76	3375	11975	1·94	2·30	2·81	3·61	. .	. .
·586	378·10	3369	11955	1·94	2·30	2·80	3·60	. .	. .
·585	377·46	3364	11935	1·94	2·29	2·80	3·60	. .	. .
·584	376·82	3358	11914	1·94	2·29	2·80	3·60	. .	. .
·583	376·18	3352	11894	1·94	2·29	2·80	3·59	. .	. .
·582	375·52	3347	11873	1·94	2·29	2·80	3·59	. .	. .
·581	374·88	3341	11853	1·93	2·29	2·79	3·59	. .	. .
·580	374·22	3335	11833	1·93	2·28	2·79	3·58	. .	. .
·579	373·60	3329	11812	1·93	2·28	2·79	3·58	. .	. .
·578	372·96	3324	11792	1 93	2·28	2·79	3·58	. .	. .
·577	372·30	3318	11771	1·93	2·28	2·78	3·57	. .	. .
·576	371·68	3312	11751	1·93	2·28	2·78	3·57	. .	. .
·575	371·04	3306	11731	1·92	2·27	2·78	3·57	.	. .
·574	370·38	3301	11710	1·92	2·27	2·78	3·57	. .	. .
·573	369·72	3295	11690	1·92	2·27	2·77	3·56	. .	. .
·572	369·10	3289	11669	1·92	2·27	2·77	3·56	. .	. .
·571	368·45	3283	11649	1·92	2·27	2·77	3·56	. .	. .
·570	367·80	3278	11628	1·91	2·26	2·77	3·55	. .	. .
·569	367·14	3272	11608	1·91	2·26	2·76	3·55	. .	. .
·568	366·50	3266	11588	1·91	2·26	2·76	3·55	. .	. .
·567	365·86	3260	11567	1·91	2·26	2·76	3·54	. .	. .
·566	365·22	3255	11547	1·91	2·26	2·76	3·54	. .	. .
·565	364·58	3249	11527	1·91	2·25	2·75	3·54	. .	. .
·564	363·92	3243	11507	1·90	2·25	2·75	3·53	. .	. .
·563	363·27	3237	11486	1·90	2·25	2·75	3·53	. .	. .
·562	362·62	3231	11466	1·90	2·25	2·75	3·53	. .	. .
·561	361·98	3226	11446	1·90	2·25	2·74	3·52	. .	. .
·560	361·34	3220	11425	1·90	2·24	2·74	3·52	. .	. .
·559	360·70	3214	11405	1·90	2·24	2·74	3·52	. .	. .
·558	360·04	3208	11385	1·89	2·24	2·74	3·52	. .	. .
·557	359·40	3203	11364	1·89	2·24	2·73	3·51	. .	. .
·556	358·76	3197	11344	1·89	2·24	2·73	3·51	. .	. .
·555	358·10	3191	11323	1·89	2·23	2·73	3·51	. .	. .
·554	357·47	3186	11303	1·89	2·23	2·73	3·50	. .	. .
·553	356·82	3180	11282	1·89	2·23	2·72	3·50	. .	. .
·552	356·18	3174	11262	1·88	2·23	2·72	3·50	. .	. .
·551	355·54	3168	11241	1·88	2·23	2·72	3·49	. .	. .
·550	354·90	3163	11221	1·88	2·22	2·72	3·49	. .	. .
·549	354·24	3157	11200	1·88	2·22	2·71	3·49	. .	. .

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·548	353·60	3151	11180	1·88	2·22	2·71	3·48	..	..
·547	352·97	3145	11160	1·88	2·22	2·71	3·48	..	..
·546	352·30	3139	11139	1·87	2·22	2·71	3·48	..	..
·545	351·64	3133	11118	1·87	2·21	2·70	3·47	..	..
·544	351·00	3128	11098	1·87	2·21	2·70	3·47	..	..
·543	350·38	3122	11077	1·87	2·21	2·70	3·47	..	..
·542	349·72	3117	11057	1·87	2·21	2·70	3·46	..	..
·541	349·08	3112	11037	1·87	2·21	2·69	3·46	..	..
·540	348·44	3105	11016	1·86	2·20	2·69	3·46	..	..
·539	347·78	3099	10996	1·86	2·20	2·69	3·45	..	..
·538	347·12	3093	10975	1·86	2·20	2·69	3·45	..	..
·537	346·50	3088	10955	1·86	2·20	2·68	3·45	..	..
·536	345·84	3082	10934	1·86	2·19	2·68	3·45	..	..
·535	345·20	3076	10914	1·86	2·19	2·68	3·44	..	..
·534	344·56	3071	10894	1·85	2·19	2·68	3·44	..	..
·533	343·92	3065	10873	1·85	2·19	2·67	3·44	..	..
·532	343·26	3059	10853	1·85	2·19	2·67	3·43	..	..
·531	342·62	3053	10832	1·85	2·18	2·67	3·43	.	..
·530	341·98	3047	10812	1·85	2·18	2·67	3·43	..	..
·529	341·32	3042	10792	1·84	2·18	2·66	3·42	..	..
·528	340·68	3036	10771	1·84	2·18	2·66	3·42	..	..
·527	340·04	3031	10751	1·84	2·18	2·66	3·42	..	..
·526	339·40	3025	10731	1·84	2·17	2·66	3·41	..	..
·525	338·76	3019	10710	1·84	2·17	2·65	3·41	..	..
·524	338·12	3013	10690	1·84	2·17	2·65	3·41	..	..
·523	337·46	3007	10669	1·83	2·17	2·65	3·40	..	..
·522	336·80	3001	10649	1·83	2·17	2·65	3·40	..	..
·521	336·18	2996	10628	1·83	2·16	2·64	3·40	..	..
·520	335·54	2990	10608	1·83	2·16	2·64	3·39	..	..
·519	334·90	2985	10588	1·83	2·16	2·64	3 39	..	..
·518	334·24	2979	10567	1·83	2·16	2·64	3·39	..	..
·517	333·60	2973	10547	1·82	2·16	2·63	3·38	..	..
·516	332·96	2967	10526	1·82	2·15	2·63	3·38	..	..
·515	332·30	2961	10506	1·82	2·15	2·63	3·38	..	..
·514	331·65	2955	10486	1·82	2·15	2·63	3·37	..	..
·513	331·00	2950	10465	1·82	2·15	2·62	3·37	..	..
·512	330·36	2944	10445	1·81	2·15	2·62	3·37	..	..
·511	329·72	2938	10425	1·81	2·14	2·62	3·36	..	..
·510	329·08	2933	10404	1·81	2·14	2·62	3·36	..	..
·509	328·44	2927	10384	1·81	2·14	2·61	3·36	..	..
·508	327·78	2921	10363	1·81	2·14	2·61	3·35	..	..
·507	327·13	2915	10343	1·81	2·13	2·61	3·35	..	..
·506	326·50	2910	10323	1·80	2·13	2·61	3·35	..	..
·505	325·84	2904	10302	1·80	2·13	2·60	3·34	..	..
·504	325·20	2898	10282	1·80	2·13	2·60	3·34	..	..
·503	324·56	2893	10261	1·80	2·13	2·60	3·34	..	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·502	323·90	2887	10241	1·80	2·12	2·60	3·33	..	..
·501	323·26	2881	10221	1·79	2·12	2·59	3·33	..	.
·500	322·61	2875	10200	1·79	2·12	2·59	3·33	..	..
·499	321·97	2869	10180	1·79	2·12	2·59	3·32	..	..
·498	321·32	2864	10159	1·79	2·12	2·58	3·32	..	..
·497	320·67	2858	10139	1·79	2·11	2·58	3·32	..	..
·496	320·03	2852	10119	1·79	2·11	2·58	3·31	..	..
495	319·40	2847	10098	1·78	2·11	2·58	3·31	..	..
·494	318·74	2841	10078	1·78	2·11	2·57	3·31	..	..
·493	318·10	2835	10057	1·78	2·11	2·57	3·30	..	..
·492	317·46	2829	10037	1·78	2·10	2·57	3·30	..	..
·491	316·80	2822	10017	1·78	2·10	2·57	3·30	..	..
·490	316·17	2818	9996	1·78	2·10	2·56	3·29	..	..
·489	315·52	2812	9976	1·77	2·10	2·56	3·29	..	..
·488	314·87	2806	9955	1·77	2·09	2·56	3·29	..	..
·487	314·22	2800	9935	1·77	2·09	2·56	3·28	..	..
·486	313·58	2795	9914	1·77	2·09	2·55	3·28	..	..
·485	312·93	2789	9894	1·77	2·09	2·55	3·28	..	..
·484	312·28	2783	9873	1·76	2·09	2·55	3·27	..	..
·483	311·65	2777	9853	1·76	2·08	2·55	3·27	..	..
·482	311·00	2772	9832	1·76	2·08	2·54	3·27	..	..
·481	310·37	2766	9812	1·76	2·08	2·54	3·26	..	..
·480	309·70	2760	9791	1·76	2·08	2·54	3·26	..	..
·479	309·06	2754	9771	1·76	2·07	2·53	3·26	..	..
·478	308·42	2748	9751	1·75	2·07	2·53	3·25	..	..
·477	307·78	2742	9730	1·75	2·07	2·53	3·25	..	..
·476	307·12	2737	9710	1·75	2·07	2·53	3·25	..	..
·475	306·50	2731	9689	1·75	2·07	2·52	3·24	..	..
·474	305·84	2725	9669	1·75	2·06	2·52	3·24	..	..
·473	305·20	2720	9649	1·74	2·06	2·52	3·24	..	..
·472	304·55	2714	9628	1·74	2·06	2·52	3·23	..	..
·471	303·90	2708	9608	1·74	2·06	2·51	3·23	..	..
·470	303·25	2702	9588	1·74	2·06	2·51	3·23	..	..
·469	302·62	2696	9567	1·74	2·05	2·51	3·22	..	..
·468	301·96	2691	9547	1·74	2·05	2·51	3·22	..	..
·467	301·32	2685	9527	1·73	2·05	2·50	3·22	..	..
·466	300·68	2679	9506	1·73	2·05	2·50	3·21	..	..
·465	300·03	2673	9486	1·73	2·04	2·50	3·21	..	..
·464	299·40	2668	9465	1·73	2·04	2·50	3·21	..	..
·463	298·73	2662	9445	1·73	2·04	2·49	3·20	..	..
·462	298·10	2657	9425	1·72	2·04	2·49	3·20	..	..
·461	297·46	2651	9404	1·72	2·04	2·49	3·19	..	..
·460	296·80	2645	9384	1·72	2·03	2·48	3·19	..	..
·459	296·16	2639	9363	1·72	2·03	2·48	3·19	..	..
·458	295·50	2633	9343	1·72	2·03	2·48	3·18	..	..
·457	294·87	2627	9322	1·71	2·03	2·48	3·18	..	..

Table No. 1.—Copper Strands—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·456	294·22	2622	9302	1·71	2·02	2·47	3·18	..	..
·455	293·58	2616	9282	1·71	2·02	2·47	3·17	..	..
·454	292·94	2610	9261	1·71	2·02	2·47	3·17	..	..
·453	292·30	2604	9241	1·71	2·02	2·47	3·17	..	..
·452	291·65	2599	9220	1·71	2·02	2·46	3·16	..	..
·451	291·00	2593	9200	1·70	2·01	2·46	3·16	..	..
·450	290·36	2587	9180	1·70	2·01	2·46	3·16	..	..
·449	289·72	2581	9159	1·70	2·01	2·45	3·15	..	..
·448	289·06	2575	9139	1·70	2·01	2·45	3·15	..	..
·447	288·40	2570	9118	1·70	2·00	2·45	3·15	..	..
·446	287·77	2564	9098	1·69	2·00	2·45	3·14	..	..
·445	287·12	2558	9078	1·69	2·00	2·44	3·14	..	..
·444	286·48	2553	9057	1·69	2·00	2·44	3·13	..	..
·443	285·83	2547	9037	1·69	1·99	2·44	3·13	..	..
·442	285·20	2542	9017	1·68	1·99	2·44	3·13	..	..
·441	284·56	2536	8996	1·68	1·99	2·43	3·12	..	..
·440	283·90	2530	8976	1·68	1·99	2·43	3·12	..	..
·439	283·25	2524	8955	1·68	1·99	2·43	3·12	..	..
·438	282·60	2518	8935	1·68	1·98	2·42	3·11	..	..
·437	281·97	2512	8915	1·68	1·98	2·42	3·11	..	..
·436	281·32	2507	8894	1·67	1·98	2·42	3·11	..	..
·435	280·68	2501	8874	1·67	1·98	2·42	3·10	..	..
·434	280·03	2495	8854	1·67	1·97	2·41	3·10	..	..
·433	279·38	2489	8833	1·67	1·97	2·41	3·10	..	..
·432	278·73	2483	8813	1·67	1·97	2·41	3·09	..	..
·431	278·10	2478	8792	1·67	1·97	2·40	3·09	..	..
·430	277·45	2472	8772	1·66	1·97	2·40	3·08	..	..
·429	276·80	2466	8751	1·66	1·96	2·40	3·08	..	..
·428	276·16	2461	8731	1·66	1·96	2·40	3·08	..	..
·427	275·50	2455	8710	1·66	1·96	2·39	3·07	..	..
·426	274·86	2449	8690	1·66	1·96	2·39	3·07	..	..
·425	374·21	2443	8669	1·65	1·95	2·39	3·07	..	..
·424	273·57	2438	8649	1·65	1·95	2·38	3·06	..	..
·423	272·93	2432	8628	1·65	1·95	2·38	3·06	..	..
·422	272·30	2426	8607	1·65	1·95	2·38	3·06	..	..
·421	271·64	2421	8587	1·65	1·94	2·38	3·05	..	..
·420	271·00	2415	8566	1·64	1·94	2·37	3·05	..	..
·419	270·35	2409	8546	1·64	1·94	2·37	3·05	..	..
·418	269·70	2403	8526	1·64	1·94	2·37	3·04	..	..
·417	269·06	2397	8505	1·64	1·94	2·36	3·04	..	..
·416	268·40	2392	8485	1·64	1·93	2·36	3·03	..	..
·415	267·77	2386	8464	1·63	1·93	2·36	3·03	..	..
·414	267·12	2380	8444	1·63	1·93	2·36	3·03	..	..
·413	266·50	2375	8424	1·63	1·93	2·35	3·02	..	..
·412	265·83	2369	8403	1·63	1·92	2·35	3·02	..	..
·411	265·18	2363	8383	1·63	1·92	2·35	3·02	4·21	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·410	264·54	2357	8363	1·62	1·92	2·35	3·01	4·21	..
·409	263·90	2352	8342	1·62	1·92	2·34	3·01	4·20	..
·408	263·26	2346	8322	1·62	1·91	2·34	3·00	4·20	..
·407	262·60	2340	8301	1·62	1·91	2·34	3·00	4·19	..
·406	261·96	2334	8281	1·62	1·91	2·33	3·00	4·19	..
·405	261·32	2328	8261	1·61	1·91	2·33	2·99	4·18	..
·404	260·66	2322	8240	1·61	1·90	2·33	2·99	4·18	..
·403	260·02	2317	8220	1·61	1·90	2·33	2·99	4·17	..
·402	259·38	2311	8199	1·61	1·90	2·32	2·98	4·17	..
·401	258·74	2305	8179	1·61	1·90	2·32	2·98	4·16	..
·400	258·08	2299	8158	1·60	1·90	2·32	2·98	4·15	..
·399	257·46	2294	8138	1·60	1·89	2·31	2·97	4·15	..
·398	256·80	2288	8118	1·60	1·89	2·31	2·97	4·14	..
·397	256·16	2282	8097	1·60	1·89	2·31	2·96	4·14	..
·396	255·50	2277	8077	1·60	1·89	2·30	2·96	4·13	..
·395	254·88	2271	8056	1·59	1·88	2·30	2·96	4·13	..
·394	254·21	2265	8036	1·59	1·88	2·30	2·95	4·12	..
·393	253·58	2259	8016	1·59	1·88	2·30	2·95	4·12	..
·392	252·92	2254	7995	1·59	1·88	2·29	2·95	4·11	..
·391	252·28	2247	7975	1·59	1·87	2·29	2·94	4·11	..
·390	251·64	2242	7955	1·58	1·87	2·29	2·94	4·10	..
·389	251·00	2236	7934	1·58	1·87	2·28	2·93	4·10	..
·388	250·35	2231	7914	1·58	1·87	2·28	2·93	4·09	..
·387	249·70	2225	7893	1·58	1·86	2·28	2·93	4·09	..
·386	249·06	2219	7873	1·58	1·86	2·28	2·92	4·08	..
·385	248·40	2213	7853	1·57	1·86	2·27	2·92	4·08	..
·384	247·78	2208	7832	1·57	1·86	2·27	2·92	4·07	..
·383	247·12	2202	7812	1·57	1·85	2·27	2·91	4·07	..
·382	246·48	2196	7791	1·57	1·85	2·26	2·91	4·06	..
·381	245·82	2190	7771	1·57	1·85	2·26	2·90	4·06	..
·380	245·12	2185	7750	1·56	1·85	2·26	2·90	4·05	..
·379	244·49	2179	7730	1·56	1·84	2·25	2·89	4·04	..
·378	243·84	2173	7710	1·56	1·84	2·25	2·89	4·04	..
·377	243·20	2167	7690	1·56	1·84	2·25	2·89	4·03	..
·376	242·64	2162	7669	1·55	1·84	2·25	2·88	4·03	..
·375	241·91	2156	7649	1·55	1·83	2·24	2·88	4·02	..
·374	241·28	2150	7629	1·55	1·83	2·24	2·88	4·02	..
·373	240·62	2144	7608	1·55	1·83	2·24	2·87	4·01	..
·372	239·99	2138	7588	1·55	1·83	2·23	2·87	4·01	..
·371	239·34	2133	7568	1·54	1·83	2·23	2·87	4·00	..
·370	238·79	2128	7548	1·54	1·82	2·23	2·86	4·00	..
·369	238·05	2121	7527	1·54	1·82	2·22	2·86	3·99	..
·368	237·38	2115	7507	1·54	1·82	2·22	2·85	3·98	..
·367	236·74	2110	7486	1·54	1·82	2·22	2·85	3·98	..
·366	236·10	2104	7466	1·53	1·81	2·22	2·85	3·97	..
·365	235·47	2099	7446	1·53	1·81	2·21	2·84	3·97	..

TABLE NO. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·364	234·80	2093	7425	1·53	1·81	2·21	2·84	3·96	..
·363	234·14	2086	7405	1·53	1·80	2·21	2·83	3·96	..
·362	233·52	2081	7385	1·53	1·80	2·20	2·83	3·95	..
·361	232·88	2075	7364	1·52	1·80	2·20	2·83	3·95	..
·360	232·23	2069	7344	1·52	1·80	2·20	2·82	3·94	..
·359	231·59	2063	7323	1·52	1·80	2·19	2·82	3·94	..
·358	230·95	2059	7303	1·52	1·79	2·19	2·81	3·93	..
·357	230·30	2052	7283	1·51	1·79	2·19	2·81	3·92	..
·356	229·68	2047	7262	1·51	1·79	2·18	2·81	3·92	..
·355	229·01	2041	7242	1·51	1·79	2·18	2·80	3·92	..
·354	228·38	2035	7221	1·51	1·78	2·18	2·80	3·91	..
·353	227·72	2029	7201	1·51	1·78	2·18	2·79	3·90	..
·352	227·09	2023	7181	1·50	1·78	2·17	2·79	3·90	..
·351	226·42	2018	7160	1·50	1·78	2·17	2·79	3·89	..
350	225·89	2013	7140	1·50	1·77	2·17	2·78	3·89	..
·349	225·14	2007	7119	1·50	1·77	2·16	2·78	3·88	..
·348	224·49	2001	7099	1·50	1·77	2·16	2·77	3·87	..
·347	223·85	1995	7079	1·49	1·76	2·16	2·77	3·87	..
·346	223·20	1989	7058	1·49	1·76	2·15	2·77	3·86	..
·345	222·58	1984	7038	1·49	1·76	2·15	2·76	3·86	..
·344	221·91	1977	7017	1·49	1·76	2·15	2·76	3·85	..
·343	221·29	1971	6997	1·48	1·75	2·14	2·75	3·85	..
·342	220·62	1965	6977	1·48	1·75	2·14	2·75	3·84	..
·341	219·99	1960	6956	1·48	1·75	2·14	2·75	3·84	..
·340	219·34	1954	6936	1·48	1·75	2·14	2·74	3·83	..
·339	218·70	1948	6915	1·48	1·74	2·13	2·74	3·82	..
·338	218·08	1942	6895	1·47	1·74	2·13	2·73	3·82	..
·337	217·40	1937	6875	1·47	1·74	2·13	2·73	3·81	..
·336	216·78	1931	6854	1·47	1·74	2·12	2·73	3·81	..
·335	216·12	1925	6834	1·47	1·73	2·12	2·72	3·80	..
·334	215·48	1920	6813	1·46	1·73	2·12	2·72	3·80	..
·333	214·82	1914	6793	1·46	1·73	2·11	2·71	3·79	..
·332	214·18	1908	6773	1·46	1·73	2·11	2·71	3·78	..
·331	213·52	1902	6752	1·46	1·72	2·11	2·71	3·78	..
·330	212·89	1897	6732	1·46	1·72	2·10	2·70	3·77	..
·329	212·24	1891	6712	1·45	1·72	2·10	2·70	3·77	..
·328	211·60	1885	6691	1·45	1·72	2·10	2·69	3·76	..
·327	210·97	1879	6671	1·45	1·71	2·09	2·69	3·76	..
·326	210·32	1874	6650	1·45	1·71	2·09	2·69	3·75	..
·325	209·68	1868	6630	1·45	1·71	2·09	2·68	3·75	..
·324	209·02	1862	6610	1·44	1·71	2·08	2·68	3·74	..
·323	208·39	1856	6589	1·44	1·70	2·08	2·67	3·73	..
·322	207·74	1850	6569	1·44	1·70	2·08	2·67	3·73	..
·321	207·09	1844	6548	1·44	1·70	2·07	2·66	3·72	..
·320	206·42	1839	6528	1·43	1·69	2·07	2·66	3·72	..
·319	205·79	1833	6508	1·43	1·69	2·07	2·66	3·71	..

TABLE NO. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·318	205·14	1828	6487	1·43	1·69	2·06	2·65	3·70	..
·317	204·49	1822	6467	1·43	1·69	2·06	2·64	3·70	..
·316	203·95	1817	6446	1·43	1·68	2·06	2·64	3·69	..
·315	203·20	1810	6426	1·42	1·68	2·05	2·64	3·69	..
·314	202·59	1805	6405	1·42	1·68	2·05	2·64	3·68	..
·313	201·95	1799	6385	1·42	1·68	2·05	2·63	3·68	..
·312	201·29	1793	6365	1·42	1·67	2·04	2·63	3·67	..
·311	200·64	1787	6344	1·41	1·67	2·04	2·62	3·66	..
·310	200·00	1782	6324	1·41	1·67	2·04	2·62	3·66	..
·309	199·34	1776	6303	1·41	1·67	2·04	2·61	3·65	..
·308	198·70	1770	6283	1·41	1·66	2·03	2·61	3·65	..
·307	198·09	1764	6262	1·40	1·66	2·03	2·61	3·64	..
·306	197·40	1759	6242	1·40	1·66	2·03	2·60	3·63	..
·305	196·79	1753	6222	1·40	1·65	2·02	2·60	3·63	..
·304	196·11	1747	6201	1·40	1·65	2·02	2·59	3·62	..
·303	195·48	1742	6181	1·40	1·65	2·02	2·59	3·62	..
·302	194·81	1736	6160	1·39	1·65	2·01	2·58	3·61	..
·301	194·19	1730	6140	1·39	1·65	2·01	2·58	3·60	..
·300	193·52	1724	6120	1·39	1·64	2·00	2·58	3·60	..
·299	192·88	1718	6099	1·39	1·64	2·00	2·57	3·59	..
·298	192·24	1712	6079	1·38	1·63	2·00	2·57	3·59	..
·297	191·60	1707	6058	1·38	1·63	2·00	2·56	3·58	.
·296	190·98	1701	6038	1·38	1·63	1·99	2·56	3·57	..
·295	190·31	1695	6018	1·38	1·63	1·99	2·55	3·57	..
·294	189·68	1690	5997	1·37	1·62	1·98	2·55	3·56	..
·293	189·02	1684	5977	1·37	1·62	1·98	2·55	3·56	..
·292	188·38	1678	5956	1·37	1·62	1·98	2·54	3·55	..
·291	187·72	1672	5936	1·37	1·62	1·97	2·54	3·54	..
·290	187·09	1667	5916	1·36	1·61	1·97	2·53	3·54	..
·289	186·42	1661	5895	1·36	1·61	1·97	2·53	3·53	..
·288	185·79	1655	5875	1·36	1·61	1·96	2·52	3·53	..
·287	185·16	1649	5854	1·36	1·60	1·96	2·52	3·52	..
·286	184·51	1644	5834	1·36	1·60	1·96	2·52	3·51	..
·285	183·86	1638	5814	1·35	1·60	1·95	2·51	3·51	..
·284	183·21	1632	5793	1·35	1·60	1·95	2·51	3·50	..
·283	182·58	1626	5773	1·35	1·59	1·95	2·50	3·49	..
·282	181·94	1620	5753	1·35	1·59	1·94	2·50	3·49	..
·281	181·29	1615	5732	1·34	1·59	1·94	2·49	3·48	.
·280	180·66	1609	5712	1·34	1·59	1·94	2·49	3·48	..
·279	179·99	1603	5691	1·34	1·58	1·93	2·48	3·47	..
·278	179·35	1598	5671	1·34	1·58	1·93	2·48	3·46	..
·277	178·70	1592	5651	1·33	1·58	1·93	2·48	3·46	..
·276	178·09	1586	5630	1·33	1·57	1·92	2·47	3·45	..
·275	177·42	1580	5610	1·33	1·57	1·92	2·47	3·45	..
·274	176·79	1574	5589	1·33	1·57	1·92	2·46	3·44	..
·273	176·12	1569	5569	1·32	1·57	1·91	2·46	3·43	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·272	175·49	1563	5549	1·32	1·56	1·91	2·45	3·43	..
·271	174·86	1557	5528	1·32	1·56	1·91	2·45	3·42	..
·270	174·20	1552	5508	1·32	1·56	1·90	2·44	3·41	..
·269	173·56	1546	5487	1·31	1·55	1·90	2·44	3·41	..
·268	172·91	1540	5467	1·31	1·55	1·90	2·43	3·40	..
267	172·26	1534	5447	1·31	1·55	1·89	2·43	3·40	..
·266	171·60	1529	5426	1·31	1·54	1·89	2·43	3·39	..
·265	170·98	1523	5406	1·30	1·54	1·88	2·42	3·38	..
·264	170·31	1517	5386	1·30	1·54	1·88	2·42	3·37	..
·263	169·68	1511	5365	1·30	1·54	1·88	2·41	3·37	..
·262	169·04	1506	5345	1·30	1·53	1·87	2·41	3·36	..
·261	168·38	1500	5324	1·29	1·53	1·87	2·40	3·36	..
·260	167·74	1494	5304	1·29	1·53	1·87	2·40	3·35	..
·259	167·10	1488	5284	1·29	1·52	1·86	2·39	3·34	..
·258	166·46	1483	5263	1·29	1·52	1·86	2·39	3·34	..
·257	165·81	1477	5243	1·28	1·52	1·86	2·38	3·33	..
·256	165·18	1471	5222	1·28	1·52	1·85	2·38	3·32	..
·255	164·51	1465	5202	1·28	1·51	1·85	2·37	3·32	..
·254	163·86	1459	5182	1·28	1·51	1·85	2·37	3·31	..
·253	163·21	1454	5161	1·27	1·51	1·84	2·37	3·30	..
·252	162·59	1449	5141	1·27	1·50	1·84	2·36	3·30	..
·251	161·92	1442	5120	1·27	1·50	1·83	2·36	3·29	..
·250	161·24	1436	5100	1·27	1·50	1·83	2·35	3·28	..
·249	160·64	1431	5079	1·26	1·49	1·83	2·35	3·28	..
·248	160·01	1425	5059	1·26	1·49	1·82	2·34	3·27	..
·247	159·36	1420	5039	1·26	1·49	1·82	2·34	3·27	..
·246	158·72	1414	5018	1·26	1·49	1·82	2·33	3·26	..
·245	158·09	1407	4998	1·25	1·48	1·81	2·33	3·25	..
·244	157·41	1402	4978	1·25	1·48	1·81	2·32	3·25	..
·243	156·78	1397	4957	1·25	1·48	1·80	2·32	3·24	..
·242	156·12	1391	4937	1·25	1·47	1·80	2·31	3·23	..
·241	155·49	1385	4916	1·24	1·47	1·80	2·31	3·22	..
·240	154·83	1379	4896	1·24	1·47	1·79	2·30	3·22	..
·239	154·19	1374	4875	1·24	1·46	1·79	2·30	3·21	..
·238	153·56	1368	4855	1·24	1·46	1·79	2·29	3·20	..
·237	152·91	1362	4835	1·23	1·46	1·78	2·29	3·20	..
·236	152·28	1356	4814	1·23	1·45	1·78	2·28	3·19	..
·235	151·62	1350	4794	1·23	1·45	1·77	2·28	3·18	..
·234	150·99	1344	4773	1·23	1·45	1·77	2·27	3·18	..
·233	150·32	1339	4753	1·22	1·45	1·77	2·27	3·17	..
·232	149·68	1334	4733	1·22	1·44	1·76	2·26	3·16	..
·231	149·04	1327	4712	1·22	1·44	1·76	2·26	3·16	..
·230	148·38	1322	4692	1·22	1·44	1·76	2·25	3·15	..
·229	147·74	1316	4671	1·21	1·43	1·75	2·25	3·14	..
·228	147·10	1310	4651	1·21	1·43	1·75	2·24	3·14	..
·227	146·46	1304	4631	1·21	1·43	1·74	2·24	3·13	..

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·226	145·82	1299	4610	1·20	1·42	1·74	2·24	3·13	..
·225	145·18	1293	4590	1·20	1·42	1·73	2·23	3·12	..
·224	144·53	1287	4569	1·20	1·42	1·73	2·23	3·11	..
·223	143·89	1282	4549	1·20	1·41	1·72	2·22	3·10	..
·222	143·23	1276	4529	1·19	1·41	1·72	2·22	3·10	..
·221	142·59	1270	4508	1·19	1·41	1·72	2·21	3·09	..
·220	141·94	1264	4488	1·19	1·40	1·72	2·21	3·08	..
·219	141·29	1258	4467	1·19	1·40	1·71	2·20	3·07	..
·218	140·66	1253	4447	1·18	1·40	1·71	2·20	3·07	..
·217	140·00	1248	4427	1·18	1·39	1·70	2·19	8·06	..
·216	139·38	1242	4406	1·18	1·39	1·70	2·19	3·05	..
·215	138·72	1236	4386	1·17	1·39	1·70	2·18	3·05	..
·214	138·09	1229	4365	1·17	1·39	1·69	2·17	3·04	..
·213	137·42	1224	4345	1·17	1·38	1·69	2·17	3·03	..
·212	136·78	1218	4325	1·17	1·38	1·68	2·16	3·02	..
·211	136·12	1212	4304	1·16	1·38	1·68	2·16	3·02	..
·210	135·49	1207	4284	1·16	1·37	1·68	2·15	3·01	..
·209	134·84	1201	4263	1·16	1·37	1·67	2·15	3·00	..
·208	134·19	1195	4243	1·16	1·37	1·67	2·14	3·00	..
·207	133·56	1189	4223	1·15	1·36	1·66	2·14	2·99	..
·206	132·91	1184	4202	1·15	1·36	1·66	2·13	2·98	..
·205	132·28	1177	4182	1·15	1·36	1·65	2·13	2·97	..
·204	131·61	1172	4161	1·14	1·35	1·65	2·12	2·97	..
·203	130·98	1166	4141	1·14	1·35	1·64	2·12	2·96	..
·202	130·32	1161	4121	1·14	1·35	1·64	2·11	2·95	..
·201	129·68	1156	4100	1·14	1·34	1·64	2·11	2·95	..
·200	129·03	1150	4080	1·13	1·34	1·63	2·11	2·94	..
·199	128·38	1144	4060	1·13	1·34	1·63	2·10	2·93	..
·198	127·75	1137	4039	1·13	1·33	1·62	2·09	2·92	..
·197	127·10	1132	4019	1·12	1·33	1·62	2·09	2·92	..
·196	126·48	1126	3998	1·12	1·33	1·62	2·08	2·91	..
·195	125·82	1120	3978	1·12	1·33	1·61	2·08	2·90	..
·194	125·18	1114	3958	1·12	1·32	1·61	2·07	2·89	..
·193	124·51	1109	3937	1·11	1·32	1·60	2·07	2·89	..
·192	123·88	1103	3917	1·11	1·31	1·60	2·06	2·88	..
·191	123·22	1097	3896	1·11	1·31	1·60	2·05	2·87	..
·190	122·58	1092	3876	1·10	1·31	1·59	2·05	2·86	..
·189	121·96	1086	3855	1·10	1·30	1·59	2·04	2·86	..
·188	121·30	1080	3835	1·10	1·30	1·59	2·04	2·85	..
·187	120·66	1075	3815	1·10	1·29	1·58	2·03	2·84	..
·186	120·00	1069	3794	1·09	1·29	1·58	2·03	2·83	..
·185	119·39	1063	3774	1·09	1·29	1·57	2·02	2·82	..
·184	118·71	1057	3753	1·09	1·28	1·57	2·02	2·82	..
·183	118·09	1052	3733	1·08	1·28	1·57	2·01	2·81	..
·182	117·42	1046	3713	1·08	1·28	1·56	2·01	2·80	..
·181	116·79	1040	3692	1·08	1·27	1·56	2·00	2·80	..

TABLE No. I.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·180	116·15	1034	3672	1·07	1·27	1·55	1·99	2·79	..
·179	115·42	1028	3651	1·07	1·27	1·55	1·99	2·78	..
·178	114·86	1022	3631	1·07	1·26	1·54	1·98	2·77	..
·177	114·20	1017	3610	1·07	1·26	1·54	1·98	2·76	..
·176	113·57	1011	3590	1·06	1·26	1·53	1·97	2·75	..
·175	112·90	1006	3570	1·06	1·25	1·53	1·97	2·75	..
·174	112·26	1000	3549	1·06	1·25	1·53	1·96	2·74	..
·173	111·62	995	3529	1·05	1·24	1·52	1·95	2·73	..
·172	110·98	988	3509	1·05	1·24	1·52	1·95	2·72	..
·171	110·34	983	3488	1·05	1·24	1·51	1·94	2·72	..
·170	109·68	977	3468	1·04	1·23	1·51	1·94	2·71	..
·169	109·05	971	3447	1·04	1·23	1·50	1·93	2·70	..
·168	108·39	966	3427	1·04	1·23	1·50	1·93	2·69	..
·167	107·74	960	3406	1·03	1·22	1·50	1·92	2·68	..
·166	107·09	954	3386	1·03	1·22	1·49	1·91	2·68	..
·165	106·47	948	3366	1·03	1·22	1·49	1·91	2·67	..
·164	105·81	943	3345	1·03	1·21	1·48	1·90	2·66	..
·163	105·18	937	3325	1·02	1·21	1·48	1·90	2·65	..
·162	104·53	931	3305	1·02	1·20	1·47	1·89	2·64	..
·161	103·88	925	3284	1·02	1·20	1·47	1·89	2·64	..
·160	103·24	920	3264	1·01	1·20	1·46	1·88	2·63	..
·159	102·58	914	3243	1·01	1·19	1·46	1·87	2·62	..
·158	101·94	908	3223	1·01	1·19	1·45	1·87	2·61	..
·157	101·30	903	3203	1·00	1·19	1·45	1·86	2·60	..
·156	100·64	897	3182	1·00	1·18	1·44	1·86	2·60	..
·155	100·00	891	3162	1·00	1·18	1·44	1·85	2·59	..
·154	99·32	885	3141	·99	1·17	1·44	1·84	2·58	..
·153	98·70	879	3121	·99	1·17	1·43	1·84	2·57	..
·152	98·02	873	3101	·99	1·17	1·43	1·83	2·56	..
·151	97·40	868	3080	·98	1·16	1·42	1·83	2·55	4·21
·150	96·77	862	3060	·98	1·16	1·42	1·83	2·54	4·19
·149	96·11	856	3039	·98	1·16	1·41	1·82	2·54	4·18
·148	95·435	850	3019	·97	1·15	1·41	1·81	2·53	4·17
·147	94·81	845	2999	·97	1·15	1·40	1·80	2·52	4·15
·146	94·14	839	2978	·97	1·14	1·40	1·80	2·51	4·13
·145	93·515	833	2958	·96	1·14	1·39	1·79	2·50	4·12
·144	92·89	828	2937	·96	1·14	1·39	1·78	2·49	4·11
·143	92·24	822	2917	·96	1·13	1·38	1·78	2·48	4·09
·142	91·60	816	2897	·95	1·13	1·38	1·77	2·47	4·08
·141	90·94	810	2876	·95	1·12	1·37	1·76	2·47	4·06
·140	90·32	804	2856	·95	1·12	1·37	1·76	2·46	4·05
·139	89·66	798	2835	·94	1·12	1·36	1·75	2·45	4·04
·138	89·02	793	2815	·94	1·11	1·36	1·75	2·44	4·02
·137	88·37	787	2795	·94	1·11	1·35	1·74	2·43	4·01
·136	87·74	781	2774	·93	1·10	1·35	1·73	2·42	3·99
·135	87·09	775	2754	·93	1·10	1·34	1·73	2·41	3·98

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·134	86·440	770	2733	0·93	1·10	1·34	1·72	2·40	3·96
·133	85·795	764	2713	·92	1·09	1·33	1·71	2·40	3·95
·132	85·150	758	2693	·92	1·09	1·33	1·71	2·39	3·93
·131	84·500	753	2672	·92	1·08	1·32	1·70	2·38	3·92
·130	83·860	747	2652	·91	1·08	1·32	1·69	2·37	3·90
·129	83·220	741	2631	·91	1·07	1·31	1·69	2·36	3·89
·128	82·570	735	2611	·91	1·07	1·31	1·68	2·35	3·88
·127	81·920	730	2591	·90	1·07	1·30	1·67	2·34	3·86
·126	81·280	724	2570	·90	1·06	1 30	1·67	2·33	3·85
·125	80·640	718	2550	·89	1·06	1·29	1·66	2·32	3·85
·124	79·990	712	2529	·89	1·05	1·29	1·65	2·31	3·82
·123	79·350	707	2509	·89	1·05	1·28	1·65	2·30	3·79
·122	78·700	701	2489	·88	1·05	1·28	1·64	2·29	3·78
·121	78·050	695	2468	·88	1·04	1·27	1·63	2·29	3·76
·120	77·410	690	2448	·88	1·04	1·27	1·63	2·28	3·75
·119	76·760	684	2427	·87	1·03	1·26	1·62	2·27	3·73
·118	76·120	678	2407	·87	1·03	1·26	1·61	2·26	3·72
·117	75·480	672	2386	·87	1·02	1·25	1·61	2·25	3·70
·116	74·830	667	2366	·86	1·02	1·24	1·60	2·24	3·69
·115	74·180	660	2346	·86	1·01	1·24	1·59	2·23	3·67
·114	73·540	655	2325	·85	1·01	1·23	1·59	2·22	3·65
·113	72·900	649	2305	·85	1·01	1·23	1·58	2·21	3·63
·112	72·250	643	2284	·85	1·00	1·22	1·57	2·20	3·62
·111	71·600	638	2264	·84	1·00	1·22	1·57	2·19	3·61
·110	70·960	632	2244	·84	·99	1·21	1·56	2·18	3·60
·109	70·320	626	2223	·84	·99	1·21	1·55	2·17	3·57
·108	69·675	620	2203	·83	·98	1·20	1·54	2·16	3·56
·107	69·025	615	2182	·83	·98	1 20	1·54	2·15	3·54
·106	68·380	609	2162	·82	·97	1·19	1·53	2·14	3·52
·105	67·735	603	2142	·82	·97	1·18	1·52	2·13	3·51
·104	67·090	597	2121	·82	·96	1·18	1·51	2·12	3·49
·103	66·440	592	2101	·81	·96	1·17	1·51	2·11	3·47
·102	65·800	586	2081	·81	·96	1·17	1·50	2·10	3·46
·101	65·155	580	2060	·80	·95	1·16	1·49	2·09	3·44
·100	64·515	575	2040	·80	·95	1·16	1·49	2·08	3·42
·099	63·860	568	2019	·80	·94	1·15	1·48	2·07	3·40
·098	63·220	563	1999	..	·94	1·14	1·47	2·06	3·39
·097	62·575	557	1978	..	·93	1·14	1·46	2·04	3·37
·096	61·920	552	1958	..	·93	1·13	1·45	2·04	3·35
·095	61·285	546	1938	..	·92	1·13	1·45	2 02	3·33
·094	60·640	540	1917	..	·92	1·12	1·44	2·01	3·32
·093	59·995	534	1897	..	·91	1·11	1·43	2·00	3·30
·092	59·350	529	1877	..	·91	1·11	1·42	1·99	3·28
·091	58·700	523	1856	..	·90	1·10	1·42	1·98	3·27
·090	58·060	517	1836	..	·90	1·10	1·41	1·97	3·25
·089	57·420	512	1815	..	·89	1·09	1·40	1·96	3·23

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.²	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·088	56·760	506	1795	..	0·89	1·08	1·39	1·95	3·21
·087	56·120	500	1775	..	·88	1·08	1·38	1·94	3·19
·086	55·480	494	1754	..	·87	1·07	1·38	1·93	3·17
·085	54·840	489	1734	..	·87	1·06	1 37	1·92	3·16
·084	54·190	483	1713	..	·87	1·06	1·37	1·90	3·14
·083	53·550	477	1693	..	·86	1·05	1·35	1·89	3·12
·082	52·900	471	1673	..	·86	1·05	1·34	1·88	3·10
·081	52·260	466	1652	..	·85	1·04	1·34	1·87	3·08
·080	51·610	460	1632	..	·85	1·03	1·33	1·86	3·06
·079	50·965	454	1611	..	·84	1·03	1·32	1·85	3·04
·078	50·320	448	1591	..	·83	1·02	1·31	1·84	3·02
·077	49·680	443	1571	..	·83	1·01	1·30	1·83	3·00
·076	49·035	437	1550	..	·82	1·01	1·29	1·81	2·98
·075	48·385	431	1530	..	·82	1·00	1·29	1·80	2·96
·074	47·740	425	1509	..	·81	·99	1·28	1·79	2·94
·073	47·095	419	1489	..	·81	·99	1·27	1·78	2·92
·072	46·450	414	1469	..	·80	·98	1·26	1·76	2·90
·071	45·810	408	1448	..	..	·97	1·25	1·75	2·88
·070	45·160	402	1428	..	..	·97	1·24	1·74	2·86
·069	44·515	397	1407	..	..	·96	1·23	1·72	2·84
·068	43·870	391	1387	..	..	·95	1·22	1·71	2·82
·067	43·230	386	1367	..	..	·95	1·22	1·70	2·80
·066	42·580	379	1346	..	..	·94	1·21	1·69	2·78
·065	41·935	374	1326	..	..	·93	1·20	1·68	2·76
·064	41·290	368	1305	..	..	·92	1·19	1·66	2·74
·063	40·650	362	1285	..	..	·92	1·18	1·65	2·72
·062	40·000	356	1265	..	..	·91	1·17	1·64	2·69
·061	39·355	351	1244	..	..	·90	1·16	1·62	2·67
·060	38·710	345	1224	..	..	·89	1·15	1·61	2·65
·059	38·065	339	1203	..	..	·89	1·14	1·59	2·63
·058	37·420	333	1183	..	..	·88	1·13	1·58	2·60
·057	36·775	328	1163	..	..	·87	1·12	1·57	2·58
·056	36·130	322	1142	..	..	·86	1·11	1·55	2·56
·055	35·480	316	1122	..	..	·86	1·10	1·54	2·54
·054	34·840	310	1101	..	..	·85	1·09	1·53	2·52
·053	34·195	305	1081	..	..	·84	1·08	1·51	2·49
·052	33·545	299	1061	..	..	·83	1·07	1·50	2·47
·051	32·910	293	1040	..	..	·82	1·06	1·48	2·44
·050	32·260	287	1020	..	..	·82	1·05	1·47	2·42
·049	31·615	282	999·8	..	..	·81	1·04	1·45	2·40
·048	30·970	276	979·2	..	..	·80	1·03	1·44	2·37
·047	30·320	270	958·8	..	..	..	1·02	1·43	2·35
·046	29·675	264	938·4	..	..	..	1·01	1·41	2·32
·045	29·030	259	918·0	..	..	..	·99	1·40	2·30
·044	28·385	253	897·6	..	..	..	·98	1·38	2·27
·043	27·745	247	877·2	..	..	..	·97	1·36	2·25

TABLE No. 1.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
sq. in.	mm.^{2}	Kilog. per km.	lb. per mile	127	91	61	37	19	7
0·042	27·095	241	856·8	..	..	..	0·96	1·34	2·22
·041	26·450	236	836·4	..	..	..	·95	1·33	2·19
·040	25·810	230	816·0	..	..	..	·94	1·32	2·17
·039	25·160	224	795·6	..	..	..	·93	1·30	2·14
·038	24·515	218	775·2	..	..	..	·91	1·28	2·11
·037	23·870	213	754·8	..	..	..	·90	1·27	2·08
·036	23·225	207	734·4	..	..	..	·89	1·25	2·05
·035	22·575	201	714·0	..	..	..	·88	1·23	2·02
·034	21·935	195	693·6	..	..	..	·86	1·21	1·99
·033	21·290	190	673·2	..	..	..	·85	1·19	1·97
·032	20·645	184	652·8	..	..	..	·84	1·18	1·94
·031	20·000	178	632·4	..	..	..	·82	1·16	1·91
·030	19·355	172	612·0	..	..	..	·81	1·14	1·87
·029	18·710	167	591·6	..	..	..	·80	1·12	1·84
·028	18·065	161	571·2	..	..	..	..	1·10	1·81
·027	17·420	155	550·8	..	..	..	..	1·08	1·78
·026	16·775	149	530·4	..	..	..	..	1·06	1·75
·025	16·130	144	510·0	..	..	..	..	1·04	1·71
·024	15·485	138	489·6	..	..	..	..	1·01	1·68
·023	14·840	132	469·2	..	..	..	..	·99	1·64
·022	14·195	126	448·8	..	..	..	..	·97	1·61
·021	13·550	121	428·4	..	..	..	..	·95	1·57
·020	12·905	115	408·0	..	..	..	..	·93	1·53
·019	12·260	109	387·6	..	..	..	..	·90	1·49
·018	11·615	104	367·2	..	..	..	..	·88	1·45
·017	10·970	98	346·8	..	..	..	..	·85	1·41
·016	10·320	92	326·4	..	..	..	..	·83	1·37
·015	9·676	86	306·0	..	..	..	..	·80	1·33
·014	9·031	81	285·6	..	..	..	..	..	1·28
·013	8·386	75	265·2	..	..	..	..	..	1·24
·012	7·740	69	244·8	..	..	..	..	..	1·19
·011	7·096	63	224·4	..	..	..	..	..	1·13
·010	6·451	57	204·0	..	..	..	..	..	1·08
·009	5·806	52	183·6	..	..	..	..	..	1·03
·008	5·161	46	163·2	..	..	..	..	..	·97
·007	4·516	40	142·8	..	..	..	..	..	·90
·006	3·871	34	122·4	..	..	..	..	..	·84
·005	3·225	29	102·0	..	..	..	..	..	·77
·004	2·580	23	81 6	..	..	..	..	..	..
·003	1·935	17	61·2	..	..	..	..	..	..
·002	1·290	11	40·8	..	..	..	..	..	..
·001	·645	6	20·4	..	..	..	..	..	..

Conversion of mm. to inches, multiply mm. by 0·03937.

TABLE No. 2.—COPPER STRANDS.

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
1000	1·550	8912	31618	3·17	3·74	..	..	..	..
999	1·548	8903	31587	3·17	3·74	..	..	..	..
998	1·546	8894	31556	3·16	3·74	..	..	..	..
997	1·545	8885	31525	3·16	3·74	..	..	..	..
996	1·543	8876	31494	3·16	3·73	..	..	..	..
995	1·542	8867	31442	3·16	3·73	..	..	..	..
994	1·540	8859	31430	3·16	3·73	..	..	..	..
993	1·539	8850	31400	3·16	3·73	..	..	..	..
992	1·537	8841	31368	3·15	3·73	..	..	..	..
991	1·536	8832	31336	3·15	3·72	..	..	..	..
990	1·534	8823	31304	3·15	3·72	..	..	..	..
989	1·532	8814	31272	3·15	3·72	..	..	..	..
988	1·531	8805	31241	3·15	3·72	..	..	..	..
987	1·529	8796	31210	3·15	3·72	..	..	..	..
986	1·528	8787	31178	3·14	3·71	..	..	..	..
985	1·526	8778	31146	3·14	3·71	..	..	..	..
984	1·525	8769	31113	3·14	3·71	..	..	..	..
983	1·523	8761	31081	3·14	3·71	..	..	..	..
982	1·522	8752	31050	3·14	3·71	..	..	..	..
981	1·520	8743	31019	3·13	3·70	..	..	..	..
980	1·519	8734	30988	3·13	3·70	..	..	..	..
979	1·517	8725	30956	3·13	3·70	..	..	..	..
978	1·515	8716	30924	3·13	3·70	..	..	..	..
977	1·514	8707	30892	3·13	3·70	..	..	..	..
976	1·512	8698	30860	3·13	3·70	..	..	..	..
975	1·511	8689	30829	3·12	3·69	..	..	..	..
974	1·509	8680	30797	3·12	3·69	..	..	..	..
973	1·508	8671	30766	3·12	3·69	..	..	..	..
972	1·506	8663	30734	3·12	3·69	..	..	..	..
971	1·505	8654	30702	3·12	3·69	..	..	..	..
970	1·503	8645	30670	3·12	3·68	..	..	..	..
969	1·501	8636	30639	3·12	3·68	..	..	..	..
968	1·500	8627	30607	3·11	3·68	..	..	..	..
967	1·498	8618	30575	3·11	3·68	..	..	..	..
966	1·497	8609	30544	3·11	3·68	..	..	..	..
965	1·495	8600	30512	3·11	3·68	..	..	..	..
964	1·494	8591	30480	3·11	3·67	..	..	..	..
963	1·492	8582	30448	3·11	3·67	..	..	..	..
962	1·491	8573	30417	3·11	3·67	..	..	..	..
961	1·489	8564	30385	3·10	3·67	..	..	..	..
960	1·488	8556	30353	3·10	3·66	..	..	..	..
959	1·486	8547	30322	3·10	3·66	..	..	..	..
958	1·484	8538	30290	3·10	3·66	..	..	..	..
957	1·483	8529	30259	3·10	3·66	..	..	..	..
956	1·481	8520	30227	3·10	3·66	..	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.^{2}	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
955	1·480	8511	30195	3·09	3·65	..	..	..	..
954	1·478	8502	30163	3·09	3·65	..	..	..	..
953	1·477	8493	30132	3·09	3·65	..	..	..	..
952	1·475	8484	30100	3·09	3·65	..	..	..	..
951	1·474	8475	30069	3·09	3·65	..	..	..	..
950	1·472	8466	30038	3·09	3·65	..	..	..	..
949	1·470	8458	30006	3·08	3·64	..	..	..	..
948	1·469	8449	29974	3·08	3·64	..	..	..	..
947	1·467	8440	29943	3·08	3·64	..	..	..	..
946	1·466	8431	29911	3·08	3·64	..	..	..	..
945	1·464	8422	29879	3·08	3·64	..	..	..	..
944	1·463	8413	29848	3·08	3·63	..	..	..	..
943	1·461	8404	29816	3·07	3·63	..	..	..	..
942	1·460	8395	29785	3·07	3·63	..	..	..	..
941	1·458	8386	29753	3·07	3·63	..	..	..	..
940	1·457	8377	29722	3·07	3·63	..	..	..	..
939	1·455	8368	29690	3·07	3·62	..	..	..	..
938	1·453	8359	29659	3·07	3·62	..	..	..	..
937	1·452	8351	29627	3·07	3·62	..	..	..	..
936	1·450	8342	29595	3·06	3·62	..	..	..	..
935	1·449	8333	29564	3·06	3·62	..	..	..	..
934	1·447	8324	29532	3·06	3·62	..	..	..	..
933	1·446	8315	29500	3·06	3·61	..	..	..	..
932	1·444	8306	29469	3·06	3·61	..	..	..	..
931	1·443	8297	29437	3·06	3·61	..	..	..	..
930	1·441	8288	29405	3·05	3·61	..	..	..	..
929	1·439	8279	29374	3·05	3·61	..	..	..	..
928	1·438	8270	29342	3·05	3·60	..	..	..	..
927	1·436	8261	29310	3·05	3·60	..	..	..	..
926	1·435	8253	29279	3·05	3·60	..	..	..	..
925	1·433	8244	29247	3·05	3·60	..	..	..	..
924	1·432	8235	29216	3·04	3·60	..	..	..	..
923	1·430	8226	29184	3·04	3·59	..	..	..	..
922	1·429	8217	29152	3·04	3·59	..	..	..	..
921	1·427	8208	29121	3·04	3·59	..	..	..	..
920	1·426	8199	29089	3·04	3·59	..	..	..	..
919	1·424	8190	29057	3·04	3·58	..	..	..	..
918	1·422	8181	29026	3·03	3·58	..	..	..	..
917	1·421	8172	28994	3·03	3·58	..	..	..	..
916	1·419	8163	28962	3·03	3·58	..	..	..	..
915	1·418	8155	28931	3·03	3·58	..	..	..	..
914	1·416	8146	28899	3·03	3·58	..	..	..	..
913	1·415	8137	28867	3·03	3·57	..	..	..	..
912	1·413	8128	28835	3·02	3·57	..	..	..	..
911	1·412	8119	28804	3·02	3·57	..	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
910	1·410	8110	28772	3·02	3·57	..	..	..	..
909	1·408	8101	28741	3·02	3·57	..	..	..	..
908	1·407	8092	28709	3·02	3·56	..	..	..	..
907	1·405	8083	28677	3·02	3·56	..	..	..	..
906	1·404	8074	28646	3·01	3·56	..	..	..	..
905	1·402	8065	28614	3·01	3·56	..	..	..	..
904	1·401	8056	28583	3·01	3·56	..	..	..	..
903	1·399	8048	28552	3·01	3·56	..	..	..	..
902	1·398	8039	28520	3·01	3·55	..	..	.	..
901	1·396	8030	28489	3·00	3·55	..	..	..	..
900	1·395	8021	28458	3·00	3·55	..	..	..	..
899	1·393	8012	28426	3·00	3·55	..	..	..	..
898	1·391	8003	28395	3·00	3·54	..	..	..	..
897	1·390	7994	28363	3·00	3·54	..	..	..	..
896	1·388	7985	28331	3·00	3·54	..	..	..	..
895	1·387	7976	28300	3·00	3·54	..	..	..	..
894	1·385	7967	28268	2·99	3·54	..	..	..	..
893	1·384	7958	28236	2·99	3·54	..	..	..	..
892	1·382	7950	28205	2·99	3·53	..	..	..	..
891	1·381	7941	28173	2·99	3·53	..	..	..	..
890	1·379	7932	28142	2·99	3·53	..	..	..	..
889	1·377	7923	28110	2·98	3·53	..	..	..	..
888	1·376	7914	28079	2·98	3·53	..	..	..	..
887	1·374	7905	28047	2·98	3·52	..	..	..	..
886	1·373	7896	28015	2·98	3·52	..	..	..	..
885	1·371	7887	27983	2·98	3·52	..	..	..	..
884	1·370	7878	27951	2·98	3·52	..	..	..	..
883	1·368	7869	27919	2·97	3·52	..	..	..	..
882	1·367	7860	27887	2·97	3·51	..	..	..	..
881	1·365	7852	27855	2·97	3·51	..	..	..	..
880	1·364	7843	27823	2·97	3·51	..	..	..	..
879	1·362	7834	27792	2·97	3·51	..	..	..	..
878	1·360	7825	27760	2·97	3·51	..	..	..	..
877	1·359	7816	27728	2·96	3·50	..	..	..	..
876	1·357	7807	27697	2·96	3·50	..	..	..	..
875	1·356	7798	27665	2·96	3·50	..	..	..	..
874	1·354	7789	27634	2·96	3·50	..	..	..	..
873	1·353	7780	27602	2·96	3.50	..	..	..	..
872	1·351	7771	27571	2·96	3·49	..	..	..	..
871	1·350	7762	27540	2·95	3·49	..	..	..	..
870	1·348	7753	27508	2·95	3·49	..	..	..	..
869	1·346	7745	27477	2·95	3·49	..	..	..	..
868	1·345	7736	27445	2·95	3·49	...	..	..	..
867	1·343	7727	27413	2·95	3·48	..	..	..	..
866	1·342	7718	27382	2·95	3·48	..	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.^{2}	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
865	1·340	7709	27350	2·95	3·48	..	..	..	..
864	1·339	7700	27318	2·94	3·48	..	..	..	..
863	1·337	7691	27287	2·94	3·48	..	..	..	..
862	1·336	7681	27255	2·94	3·47	..	..	..	..
861	1·334	7673	27224	2·94	3·47	..	..	..	..
860	1·333	7664	27192	2·94	3·47	..	..	..	..
859	1·331	7655	27161	2·93	3·47	..	..	..	..
858	1·329	7647	27129	2·93	3·46	..	..	..	..
857	1·328	7638	27098	2·93	3·46	..	..	..	..
856	1·326	7629	27066	2·93	3·46	..	..	..	..
855	1·325	7620	27034	2·93	3·46	..	..	..	..
854	1·323	7611	27003	2·93	3·46	..	..	..	..
853	1·322	7602	26971	2·92	3·45	..	..	..	..
852	1·320	7593	26940	2·92	3·45	..	..	..	..
851	1·319	7584	26908	2·92	3·45	4·21	..	..	..
850	1·317	7575	26876	2·92	3·45	4·21	..	..	..
849	1·315	7566	26845	2·92	3·45	4·21	..	..	..
848	1·314	7557	26813	2·92	3·44	4·21	..	..	..
847	1·312	7549	26781	2·91	3·44	4·21	..	..	..
846	1·311	7540	26749	2·91	3·44	4·20	..	..	..
845	1·309	7531	26718	2·91	3·44	4·20	..	..	..
844	1·308	7522	26686	2·91	3·44	4·20	..	..	..
843	1·306	7513	26654	2·91	3·43	4·20	..	..	..
842	1·305	7504	26622	2·91	3·43	4·19	..	..	..
841	1·303	7495	26590	2·90	3·43	4·19	..	..	..
840	1·302	7486	26558	2·90	3·43	4·19	..	..	..
839	1·300	7477	26527	2·90	3·43	4·18	..	..	..
838	1·298	7468	26495	2·90	3·42	4·18	..	..	..
837	1·297	7459	26463	2·90	3·42	4·18	..	..	..
836	1·295	7450	26432	2·90	3·42	4·18	..	..	..
835	1·294	7442	26400	2·89	3·42	4·17	..	..	..
834	1·292	7433	26369	2·89	3·42	4·17	..	..	..
833	1·291	7424	26337	2·89	3·41	4·17	..	..	..
832	1·289	7415	26306	2·89	3·41	4·17	..	..	..
831	1·288	7406	26274	2·89	3·41	4·16	..	..	..
830	1·286	7397	26243	2·88	3·41	4·16	..	..	..
829	1·284	7388	26211	2·88	3·41	4·16	..	..	..
828	1·283	7379	26180	2·88	3·40	4·16	..	..	..
827	1·281	7370	26148	2·88	3·40	4·15	..	..	..
826	1·280	7361	26116	2·88	3·40	4·15	..	..	..
825	1·278	7352	26085	2·88	3·40	4·15	..	..	..
824	1·277	7344	26053	2·87	3·40	4·15	..	..	..
823	1·275	7335	26022	2·87	3·39	4·14	..	..	..
822	1·274	7326	25990	2·87	3·39	4·14	..	..	..
821	1·272	7317	25959	2·87	3·39	4·14	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
820	1·271	7308	25928	2·87	3·39	4·14	..	..	..
819	1·269	7299	25896	2·87	3·39	4·13	..	..	..
818	1·267	7290	25864	2·86	3·38	4·13	..	..	..
817	1·266	7281	25833	2·86	3·38	4·13	..	..	..
816	1·264	7272	25801	2·86	3·38	4·13	..	..	..
815	1·263	7263	25770	2·86	3·38	4·13	..	..	..
814	1·261	7254	25738	2·86	3·38	4·12	..	..	..
813	1·260	7245	25707	2·85	3·37	4·12	..	..	..
812	1·258	7237	25675	2·85	3·37	4·12	..	..	..
811	1·257	7228	25643	2·85	3·37	4·12	..	..	..
810	1·255	7219	25612	2·85	3·37	4·11	..	..	..
809	1·253	7210	25580	2·85	3·36	4·11	..	..	..
808	1·252	7201	25549	2·85	3·36	4·11	..	..	..
807	1·250	7192	25518	2·84	3·36	4·10	..	..	..
806	1·249	7183	25486	2·84	3·36	4·10	..	..	..
805	1·247	7174	25454	2·84	3·36	4·10	..	..	..
804	1·246	7165	25422	2·84	3·35	4·10	..	..	..
803	1·244	7156	25391	2·84	3·35	4·09	..	..	..
802	1·243	7147	25359	2·84	3·35	4·09	..	..	..
801	1·241	7139	25327	2·83	3·35	4·09	..	..	..
800	1·240	7130	25295	2·83	3·35	4·09	..	..	..
799	1·238	7121	25264	2·83	3·34	4·08	..	..	..
798	1·236	7112	25232	2·83	3·34	4·08	..	..	..
797	1·235	7103	25200	2·83	3·34	4·08	..	..	..
796	1·233	7094	25168	2·83	3·34	4·08	..	..	..
795	1·232	7085	25137	2·82	3·34	4·07	..	..	..
794	1·230	7076	25105	2·82	3·33	4·07	..	..	..
793	1·229	7067	25073	2·82	3·33	4·07	..	..	..
792	1·227	7058	25042	2·82	3·33	4·07	..	..	..
791	1·226	7049	25010	2·82	3·33	4·06	..	..	..
790	1·224	7041	24979	2·81	3·32	4·06	..	..	..
789	1·222	7032	24947	2·81	3·32	4·06	..	..	..
788	1·221	7023	24915	2·81	3·32	4·06	..	..	..
787	1·219	7014	24884	2·81	3·32	4·05	..	..	..
786	1·218	7005	24852	2·81	3·32	4·05	..	..	..
785	1·216	6996	24820	2·81	3·31	4·05	..	..	..
784	1·215	6987	24789	2·80	3·31	4·05	..	..	..
783	1·213	6978	24757	2·80	3·31	4·04	..	..	..
782	1·212	6969	24726	2·80	3·31	4·04	..	..	..
781	1·210	6960	24694	2·80	3·31	4·04	..	..	..
780	1·209	6951	24663	2·80	3·30	4·03	..	..	..
779	1·207	6942	24631	2·79	3·30	4·03	..	..	..
778	1·205	6934	24600	2·79	3·30	4·03	..	..	..
777	1·204	6925	24569	2·79	3·30	4·03	..	..	..
776	1·202	6916	24537	2·79	3·30	4·02	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
775	1·201	6907	24505	2·79	3·29	4·02	..	..	..
774	1·199	6898	24473	2·78	3·29	4·02	..	..	..
773	1·198	6890	24441	2·78	3·29	4·02	..	..	..
772	1·196	6880	24410	2·78	3·29	4·01	..	..	..
771	1·195	6871	24378	2·78	3·28	4·01	..	..	..
770	1·193	6862	24347	2·78	3·28	4·01	..	..	..
769	1·191	6853	24315	2·78	3·28	4·01	..	..	..
768	1·190	6844	24283	2·77	3·28	4·00	..	..	..
767	1·188	6836	24252	2·77	3·28	4·00	..	..	..
766	1·187	6827	24220	2·77	3·27	4·00	..	..	..
765	1·185	6818	24188	2·77	3·27	4·00	..	..	..
764	1·184	6809	24157	2·77	3·27	3·99	..	..	..
763	1·182	6800	24125	2·76	3·27	3·99	..	..	..
762	1·181	6791	24094	2·76	3·27	3·99	..	..	..
761	1·179	6782	24062	2·76	3·26	3·98	..	..	..
760	1·178	6773	24030	2·76	3·26	3·98	..	..	..
759	1·176	6764	23999	2·76	3·26	3·98	..	..	..
758	1·174	6755	23967	2·76	3·26	3·98	..	..	..
757	1·173	6746	23936	2·75	3·25	3·97	..	..	..
756	1·171	6738	23904	2·75	3·25	3·97	..	..	..
755	1·170	6729	23873	2·75	3·25	3·97	..	..	..
754	1·168	6720	23841	2·75	3·25	3·97	..	..	..
753	1·167	6711	23810	2·75	3·25	3·96	..	..	..
752	1·165	6702	23778	2·75	3·24	3·96	..	..	..
751	1·164	6693	23746	2·74	3·24	3·96	..	..	..
750	1·162	6684	23714	2·74	3·24	3·96	..	..	..
749	1·160	6675	23683	2·74	3·24	3·95	..	..	..
748	1·159	6666	23651	2·74	3·24	3·95	..	..	..
747	1·157	6657	23620	2·74	3·23	3·95	..	..	..
746	1·156	6648	23588	2·74	3·23	3·95	..	..	..
745	1·154	6639	23557	2·73	3·23	3·94	..	..	..
744	1·153	6631	23525	2·73	3·23	3·94	..	..	..
743	1·151	6622	23493	2·73	3·22	3·94	..	..	..
742	1·150	6613	23461	2·73	3·22	3·94	..	..	..
741	1·148	6604	23430	2·73	3·22	3·93	..	..	..
740	1·147	6595	23398	2·72	3·22	3·93	..	..	..
739	1·145	6586	23367	2·72	3·21	3·93	..	..	..
738	1·143	6577	23335	2·72	3·21	3·92	..	..	..
737	1·142	6568	23303	2·72	3·21	3·92	..	..	..
736	1·140	6559	23271	2·72	3·21	3·92	..	..	..
735	1·139	6550	23240	2·71	3·21	3·92	..	..	..
734	1·137	6541	23208	2·71	3·20	3·91	..	..	..
733	1·136	6533	23176	2·71	3·20	3·91	..	..	..
732	1·134	6524	23144	2·71	3·20	3·91	..	..	..
731	1·133	6515	23112	2·71	3·20	3·91	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
730	1·131	6506	23080	2·71	3·20	3·90	..	..	..
729	1·129	6497	23049	2·70	3·19	3·90	..	..	..
728	1·128	6488	23017	2·70	3·19	3·90	..	..	..
727	1·126	6479	22985	2·70	3·19	3·90	..	..	..
726	1·125	6470	22954	2·70	3·19	3·89	..	..	..
725	1·123	6461	22922	2·70	3·19	3·89	..	..	..
724	1·122	6452	22890	2·69	3·18	3·89	..	..	..
723	1·120	6443	22859	2·69	3·18	3·88	..	..	..
722	1·119	6435	22828	2·69	3·18	3·88	..	..	..
721	1·117	6426	22797	2·69	3·18	3·88	..	..	..
720	1·116	6417	22766	2·69	3·17	3·88	..	..	..
719	1·114	6408	22734	2·68	3·17	3·87	..	..	..
718	1·112	6399	22702	2·68	3·17	3·87	..	..	..
717	1·111	6390	22670	2·68	3·17	3·87	..	..	..
716	1·109	6381	22639	2·68	3·17	3·87	..	..	..
715	1·108	6372	22607	2·68	3·16	3·86	..	..	..
714	1·106	6363	22575	2·68	3·16	3·86	..	..	..
713	1·105	6354	22544	2·67	3·16	3·86	..	..	..
712	1·103	6345	22513	2·67	3·16	3·86	..	..	..
711	1·102	6336	22481	2·67	3·15	3·85	..	..	..
710	1·100	6328	22450	2·67	3·15	3·85	..	..	..
709	1·098	6319	22418	2·67	3·15	3·85	..	..	..
708	1·097	6310	22386	2·66	3·15	3·84	..	..	..
707	1·095	6301	22354	2·66	3·14	3·84	..	..	..
706	1·094	6292	22323	2·66	3·14	3·84	..	..	..
705	1·092	6283	22291	2·66	3·14	3·84	..	..	..
704	1·091	6274	22259	2·66	3·14	3·83	..	..	..
703	1·089	6265	22227	2·65	3·14	3·83	..	..	..
702	1·088	6256	22196	2·65	3·13	3·83	..	..	..
701	1·086	6247	22165	2·65	3·13	3·82	..	..	..
700	1·085	6238	22133	2·65	3·13	3·82	..	..	..
699	1·083	6230	22102	2·65	3·13	3·82	..	..	..
698	1·081	6221	22070	2·65	3·13	3·82	..	..	..
697	1·080	6212	22038	2·64	3·12	3·81	..	..	..
696	1·078	6203	22007	2·64	3·12	3·81	..	..	..
695	1·077	6194	21975	2·64	3·12	3·81	..	..	..
694	1·075	6185	21944	2·64	3·12	3·81	..	..	..
693	1·074	6176	21912	2·64	3·11	3·80	..	..	..
692	1·072	6167	21880	2·63	3·11	3·80	..	..	..
691	1·071	6158	21849	2·63	3·11	3·80	..	..	..
690	1·069	6149	21817	2·63	3·11	3·79	..	..	..
689	1·067	6140	21785	2·63	3·11	3·79	..	..	..
688	1·066	6131	21754	2·63	3·10	3·79	..	..	..
687	1·064	6123	21722	2·62	3·10	3·79	..	..	..
686	1·063	6114	21690	2·62	3·10	3·78	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
685	1·061	6105	21659	2·62	3·10	3·78	..	..	..
684	1·060	6096	21627	2·62	3·09	3·78	..	..	..
683	1·058	6087	21596	2·62	3·09	3·78	..	..	..
682	1·057	6078	21564	2·62	3·09	3·77	..	..	..
681	1·055	6069	21532	2·61	3·09	3·77	..	..	..
680	1·054	6060	21501	2·61	3·09	3·77	..	..	..
679	1·052	6051	21469	2·61	3·08	3·76	..	..	..
678	1·050	6042	21437	2·61	3·08	3·76	..	..	..
677	1·049	6033	21406	2·61	3·08	3·76	..	..	..
676	1·047	6025	21374	2·60	3·08	3·76	..	..	..
675	1·046	6016	21342	2·60	3·07	3·75	..	..	..
674	1·044	6007	21311	2·60	3·07	3·75	..	..	..
673	1·043	5998	21279	2·60	3·07	3·75	..	..	..
672	1·041	5989	21247	2·60	3·07	3·75	..	..	..
671	1·040	5980	21216	2·59	3·06	3·74	..	..	..
670	1·038	5971	21184	2·59	3·06	3·74	..	..	..
669	1·036	5962	21152	2·59	3·06	3·74	..	..	..
668	1·035	5953	21121	2·59	3·06	3·73	..	..	..
667	1·033	5944	21089	2·59	3·06	3·73	..	..	..
666	1·032	5935	21058	2·58	3·05	3·73	..	..	..
665	1·030	5927	21026	2·58	3·05	3·73	..	..	..
664	1·029	5918	20994	2·58	3·05	3·72	..	..	..
663	1·027	5909	20963	2·58	3·05	3·72	..	..	..
662	1·026	5900	20931	2·58	3·04	3·72	..	..	.
661	1·024	5891	20900	2·57	3·04	3·71	..	..	..
660	1·023	5882	20868	2·57	3·04	3·71	..	..	..
659	1·021	5873	20836	2·57	3·04	3·71	..	..	..
658	1·019	5864	20805	2·57	3·03	3·71	..	..	..
657	1·018	5855	20773	2·57	3·03	3·70	..	..	..
656	1·016	5846	20742	2·56	3·03	3·70	..	..	.
655	1·015	5837	20710	2·56	3·03	3·70	..	..	..
654	1·013	5828	20679	2·56	3·03	3·69	..	..	..
653	1·012	5820	20647	2·56	3·02	3·69	..	..	..
652	1·010	5811	20616	2·56	3·02	3·69	..	..	..
651	1·009	5802	20584	2·56	3·02	3·69	..	..	..
650	1·007	5793	20552	2·55	3·02	3·68	..	..	..
649	1·005	5784	20521	2·55	3·01	3·68	..	..	.
648	1·004	5775	20489	2·55	3·01	3·68	..	..	..
647	1·002	5766	20458	2·55	3·01	3·68	..	..	..
646	1·001	5757	20427	2·55	3·01	3·67	..	..	..
645	·999	5748	20395	2·54	3·00	3·67	..	..	..
644	·998	5739	20364	2·54	3·00	3·67	..	..	..
643	·996	5730	20332	2·54	3·00	3·66	..	..	..
642	·995	5722	20301	2·54	3·00	3·66	..	..	..
641	·993	5713	20269	2·54	3·00	3·66	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
$mm.^2$	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
640	0·992	5704	20237	2·53	2·99	3·66	..	..	..
639	·990	5695	20206	2·53	2·99	3·65	..	..	..
638	·988	5686	20174	2·53	2·99	3·65	..	..	..
637	·987	5677	20143	2·53	2·99	3·65	..	..	..
636	·985	5668	20111	2·53	2·98	3·64	..	..	..
635	·984	5659	20079	2·52	2·98	3·64	..	..	..
634	·982	5650	20047	2·52	2·98	3·64	..	..	..
633	·981	5641	20015	2·52	2·98	3·63	..	..	..
632	·979	5632	19983	2·52	2·97	3·63	..	..	..
631	·978	5624	19951	2·52	2·97	3·63	..	..	..
630	·976	5615	19919	2·51	2·97	3·63	..	..	..
629	·974	5606	19888	2·51	2·97	3·62	..	..	..
628	·973	5597	19856	2·51	2·96	3·62	..	..	..
627	·971	5588	19825	2·51	2·96	3·62	..	..	..
626	·970	5579	19793	2·51	2·96	3·62	..	..	..
625	·968	5570	19761	2·50	2·96	3·61	..	..	..
624	·967	5561	19730	2·50	2·96	3·61	..	..	..
623	·965	5552	19698	2·50	2·95	3·61	..	..	..
622	·964	5543	19667	2·50	2·95	3·60	..	..	..
621	·962	5534	19635	2·50	2·95	3·60	..	..	..
620	·961	5525	19604	2·49	2·95	3·60	..	..	..
619	·959	5517	19572	2·49	2·94	3·59	..	..	..
618	·957	5508	19541	2·49	2·94	3·59	..	..	..
617	·956	5499	19509	2·49	2·94	3·59	..	..	..
616	·954	5490	19478	2·49	2·94	3·59	..	..	..
615	·953	5481	19446	2·48	2·93	3·58	..	..	..
614	·951	5472	19414	2·48	2·93	3·58	..	..	..
613	·950	5463	19383	2·48	2·93	3·58	..	..	..
612	·948	5454	19351	2·48	2·93	3·57	..	..	..
611	·947	5445	19319	2·47	2·92	3·57	..	..	..
610	·945	5436	19288	2·47	2·92	3·57	..	..	..
609	·943	5427	19256	2·47	2·92	3·57	..	..	..
608	·942	5419	19225	2·47	2·92	3·56	..	..	..
607	·940	5410	19193	2·47	2·91	3·56	..	..	..
606	·939	5401	19161	2·46	2·91	3·56	..	..	..
605	·937	5392	19130	2·46	2·91	3·55	..	..	..
604	·936	5383	19098	2·46	2·91	3·55	..	..	..
603	·934	5374	19066	2·46	2·91	3·55	..	..	..
602	·933	5365	19035	2·46	2·90	3·54	..	..	..
601	·931	5356	19003	2·45	2·90	3·54	..	..	..
600	·930	5347	18971	2·45	2·90	3·54	..	..	..
599	·928	5338	18940	2·45	2·90	3·54	..	..	..
598	·926	5329	18908	2·45	2·89	3·53	..	..	..
597	·925	5321	18876	2·45	2·89	3·53	..	..	..
596	·923	5312	18845	2·45	2·89	3·53	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
595	0·922	5303	18813	2·44	2·89	3·52	..	..	..
594	·920	5294	18782	2·44	2·88	3·52	..	..	..
593	·919	5285	18750	2·44	2·88	3·52	..	..	..
592	·917	5276	18719	2·44	2·88	3·52	..	..	..
591	·916	5267	18687	2·44	2 88	3·51	..	..	..
590	·914	5258	18656	2·43	2·87	3·51	..	..	..
589	·912	5249	18624	2·43	2·87	3·51	..	..	..
588	·911	5240	18592	2·43	2·87	3·50	..	..	..
587	·909	5231	18561	2·43	2·87	3·50	..	..	..
586	·908	5222	18529	2·42	2·86	3·50	.	..	..
585	·906	5214	18498	2·42	2·86	3·49	..	..	..
584	·905	5205	18466	2·42	2·86	3·49	..	..	..
583	·903	5196	18434	2·42	2·86	3·49	..	..	..
582	·902	5187	18392	2·42	2·85	3·49	..	..	..
581	·900	5178	18360	2·41	2·85	3·48	..	..	..
580	·899	5169	18338	2·41	2·85	3·48	..	..	..
579	·897	5160	18307	2·41	2·85	3·48	..	..	..
578	·895	5151	18276	2·41	2·84	3·47	..	..	..
577	·894	5142	18244	2·40	2·84	3·47	..	..	..
576	·892	5133	18213	2·40	2·84	3·47	..	..	..
575	·891	5124	18181	2·40	2·84	3·46	..	..	..
574	·889	5116	18149	2·40	2·83	3·46	..	..	..
573	·888	5107	18118	2·40	2·83	3·46	..	..	..
572	·886	5098	18086	2·39	2·83	3·45	..	..	..
571	·885	5089	18055	2·39	2·83	3·45	..	..	..
570	·883	5080	18023	2·39	2·82	3·45	..	..	..
569	·881	5071	17991	2·39	2·82	3·45	..	..	..
568	·880	5062	17960	2·39	2·82	3·44	..	..	..
567	·878	5053	17928	2·38	2·82	3·44	..	..	..
566	·877	5044	17896	2·38	2·81	3·44	..	..	..
565	·875	5035	17865	2·38	2·81	3·43	..	..	..
564	·874	5026	17833	2·38	2·81	3·43	..	..	..
563	·872	5017	17802	2·38	2·81	3·43	..	..	..
562	·871	5009	17770	2·38	2·80	3·43	..	..	..
561	·869	5000	17739	2·37	2·80	3·42	..	..	..
560	·868	4991	17708	2·37	2·80	3·42	..	..	..
559	·866	4982	17676	2·37	2·80	3·42	..	..	..
558	·864	4973	17645	2·37	2 79	3·41	..	..	..
557	·863	4964	17613	2·36	2·79	3·41	..	..	..
556	·861	4955	17581	2·36	2·79	3·41	..	..	..
555	·860	4946	17550	2·36	2·79	3·40	..	..	..
554	·858	4937	17518	2·36	2·78	3·40	..	..	..
553	·857	4928	17486	2·35	2·78	3·40	..	..	..
552	·855	4919	17454	2·35	2·78	3·39	..	..	..
551	·854	4911	17422	2·35	2·78	3·39	..	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
550	0·852	4902	17390	2·35	2·77	3·39	..	..	..
549	·850	4893	17359	2·35	2·77	3·39	..	..	..
548	·849	4884	17327	2·34	2·77	3·38	..	..	..
547	·847	4875	17295	2·34	2·77	3·38	..	..	..
546	·846	4866	17264	2·34	2·76	3·38	..	..	..
545	·844	4857	17232	2·34	2·76	3·37	..	..	..
544	·843	4848	17201	2·33	2·76	3·37	..	..	..
543	·841	4839	17169	2·33	2·76	3·37	..	..	..
542	·840	4830	17138	2·33	2·75	3·36	..	..	..
541	·838	4821	17106	2·33	2·75	3·36	..	..	..
540	·837	4813	17075	2·33	2·75	3·36	..	..	..
539	·835	4804	17043	2·32	2·75	3·35	..	..	..
538	·833	4795	17011	2·32	2·74	3·35	..	..	..
537	·832	4786	16980	2·32	2·74	3·35	..	..	..
536	·830	4777	16948	2·32	2·74	3·35	..	..	..
535	·829	4768	16916	2·32	2·74	3·34	..	..	..
534	·827	4759	16885	2·31	2·73	3·34	..	..	..
533	·826	4750	16853	2·31	2·73	3·34	..	..	..
532	·824	4741	16822	2·31	2·73	3·33	..	..	..
531	·823	4732	16790	2·31	2·73	3·33	..	..	..
530	·821	4723	16758	2·31	2·72	3·33	..	..	..
529	·819	4714	16727	2·30	2·72	3·32	..	..	..
528	·818	4706	16695	2·30	2·72	3·32	..	..	..
527	·816	4697	16663	2·30	2·72	3·32	..	..	..
526	·815	4688	16632	2·30	2·71	3·31	..	..	..
525	·813	4679	16600	2·30	2·71	3·31	..	..	..
524	·812	4670	16569	2·29	2·71	3·31	..	..	..
523	·810	4660	16537	2·29	2·70	3·30	..	..	..
522	·809	4652	16505	2·29	2·70	3·30	..	..	..
521	·807	4643	16474	2·29	2·70	3·30	..	..	..
520	·806	4634	16442	2·28	2·70	3·29	..	..	..
519	·804	4625	16411	2·28	2·69	3·29	..	..	..
518	·802	4616	16379	2·28	2·69	3·29	..	..	..
517	·801	4608	16347	2·28	2·69	3·28	..	..	..
516	·799	4599	16316	2·28	2·69	3·28	4·21	..	..
515	·798	4590	16284	2·27	2·68	3·28	4·21	..	..
514	·796	4581	16253	2·27	2·68	3·28	4·21	..	..
513	·795	4572	16221	2·27	2·68	3·27	4·20	..	..
512	·793	4563	16190	2·27	2·68	3·27	4·20	..	..
511	·792	4554	16158	2·27	2·67	3·27	4·19	..	..
510	·790	4545	16127	2·26	2·67	3·26	4·19	..	..
509	·788	4536	16095	2·26	2·67	3·26	4·19	..	..
508	·787	4527	16064	2·26	2·66	3·26	4·18	..	..
507	·785	4518	16032	2·26	2·66	3·25	4·18	..	..
506	·784	4510	16001	2·26	2·66	3·25	4·17	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
505	0·782	4501	15969	2·25	2·65	3·25	4·17	..	..
504	·781	4492	15937	2·25	2·65	3·24	4·16	..	..
503	·779	4483	15905	2·25	2·65	3·24	4·16	..	..
502	·778	4474	15873	2·24	2·65	3·24	4·16	..	..
501	·776	4465	15841	2·24	2·64	3·23	4·15	..	..
500	·775	4456	15809	2·24	2·64	3·23	4·15	..	..
499	·773	4447	15778	2·24	2·64	3·23	4·14	..	..
498	·771	4438	15746	2·23	2·64	3·22	4·14	..	..
497	·770	4429	15714	2·23	2·63	3·22	4·14	..	..
496	·768	4420	15683	2·23	2·63	3·22	4·13	..	..
495	·767	4411	15651	2·23	2·63	3·21	4·13	..	..
494	·765	4403	15619	2·23	2·63	3·21	4·12	..	..
493	·764	4394	15588	2·22	2·62	3·21	4·12	..	..
492	·762	4385	15556	2·22	2·62	3·20	4·11	..	..
491	·761	4376	15525	2·22	2·62	3·20	4·11	..	..
490	·759	4367	15493	2·22	2·62	3·20	4·11	..	..
489	·757	4357	15461	2·21	2·61	3·20	4·10	..	..
488	·756	4349	15430	2·21	2·61	3·19	4·10	..	..
487	·754	4340	15399	2·21	2·61	3·19	4·09	..	..
486	·753	4331	15367	2·21	2·61	3·19	4·09	..	..
485	·751	4322	15335	2·20	2·60	3·18	4·09	..	..
484	·750	4313	15304	2·20	2·60	3·18	4·08	..	..
483	·748	4305	15272	2·20	2·60	3·18	4·08	..	..
482	·747	4296	15240	2·20	2·59	3·17	4·07	..	..
481	·745	4287	15208	2·20	2·59	3·17	4·07	..	..
480	·744	4278	15176	2·19	2·59	3·17	4·06	..	..
479	·742	4269	15145	2·19	2·59	3·16	4·06	..	..
478	·740	4260	15113	2·19	2·59	3·16	4·06	..	..
477	·739	4251	15081	2·19	2·58	3·16	4·05	..	..
476	·737	4242	15050	2·18	2·58	3·15	4·05	..	..
475	·736	4233	15018	2·18	2·58	3·15	4·04	..	..
474	·734	4224	14987	2·18	2·57	3·15	4·04	..	..
473	·733	4215	14955	2·18	2·57	3·14	4·04	..	..
472	·731	4207	14924	2·17	2·57	3·14	4·03	..	..
471	·730	4198	14893	2·17	2·57	3·14	4·03	..	..
470	·728	4189	14862	2·17	2·56	3·13	4·02	..	..
469	·726	4178	14830	2·17	2·56	3·13	4·02	..	..
468	·725	4171	14799	2·17	2·56	3·13	4·01	..	..
467	·723	4162	14767	2·16	2·56	3·12	4·01	..	..
466	·722	4152	14735	2·16	2·55	3·12	4·00	..	..
465	·720	4144	14704	2·16	2·55	3·12	4·00	..	..
464	·719	4135	14672	2·16	2·55	3·11	4·00	..	..
463	·717	4126	14640	2·16	2·54	3·11	3·99	..	..
462	·716	4117	14609	2·15	2·54	3·11	3·99	..	..
461	·714	4108	14577	2·15	2·54	3·10	3·98	..	..

Table No. 2.—Copper Strands—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
460	0·713	4099	14545	2·15	2·54	3·10	3·98	..	..
459	·711	4091	14514	2·15	2·53	3·10	3·97	..	..
458	·709	4082	14482	2·14	2·53	3·09	3·97	..	..
457	·708	4073	14450	2·14	2·53	3·09	3·97	..	..
456	·706	4064	14419	2·14	2·53	3·09	3·96	..	..
455	·705	4055	14387	2·14	2·52	3·08	3·96	..	..
454	·703	4046	14356	2·13	2·52	3·08	3·95	..	..
453	·702	4037	14324	2·13	2·52	3·08	3·95	..	..
452	·700	4028	14293	2·13	2·51	3·07	3·94	..	..
451	·699	4019	14261	2·13	2·51	3·07	3·94	..	..
450	·697	4010	14230	2·12	2·51	3·06	3·94	..	..
449	·695	4002	14198	2·12	2·51	3·06	3·93	..	..
448	·694	3993	14166	2·12	2·50	3·06	3·93	..	..
447	·692	3984	14134	2·12	2·50	3·05	3·92	..	..
446	·691	3975	14103	2·12	2·50	3·05	3·92	..	..
445	·689	3966	14071	2·11	2·50	3·05	3·91	..	..
444	·688	3957	14039	2·11	2·49	3·04	3·91	..	..
443	·686	3948	14008	2·11	2·49	3·04	3·90	..	..
442	·685	3939	13976	2·11	2·49	3·04	3·90	..	..
441	·683	3930	13944	2·10	2·48	3·03	3·90	..	..
440	·682	3921	13913	2·10	2·48	3·03	3·89	..	..
439	·680	3912	13881	2·10	2·48	3·03	3·89	..	..
438	·678	3903	13850	2·10	2·47	3·02	3·88	..	..
437	·677	3895	13818	2·09	2·47	3·02	3·88	..	..
436	·675	3886	13786	2·09	2·47	3·02	3·88	..	..
435	·674	3877	13755	2·09	2·47	3·01	3·87	..	..
434	·672	3868	13723	2·09	2·46	3·01	3·86	..	..
433	·671	3859	13691	2·08	2·46	3·01	3·86	..	..
432	·669	3849	13659	2·08	2·46	3·00	3·85	..	..
431	·668	3841	13628	2·08	2·46	3·00	3·85	..	..
430	·666	3832	13597	2·08	2·45	3·00	3·85	..	..
429	·664	3823	13565	2·07	2·45	2·99	3·84	..	..
428	·663	3814	13533	2·07	2·45	2·99	3·84	..	..
427	·661	3805	13501	2·07	2·44	2·99	3·83	..	..
426	·660	3797	13470	2·07	2·44	2·98	3·83	..	..
425	·658	3788	13438	2·06	2·44	2·98	3·82	..	..
424	·657	3779	13406	2·06	2·44	2·97	3·82	..	..
423	·655	3770	13375	2·06	2·43	2·97	3·82	..	..
422	·654	3761	13343	2·06	2·43	2·97	3·81	..	..
421	·652	3752	13311	2·05	2·43	2·96	3·81	..	..
420	·651	3743	13280	2·05	2·43	2·96	3·80	..	..
419	·649	3734	13248	2·05	2·42	2·96	3·80	..	..
418	·647	3725	13217	2·05	2·42	2·95	3·79	..	..
417	·646	3716	13185	2·04	2·42	2·95	3·79	..	..
416	·644	3707	13153	2·04	2·41	2·95	3·78	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
415	0·643	3699	13122	2·04	2·41	2·94	3·78	..	..
414	·641	3690	13090	2·04	2·41	2·94	3·77	..	..
413	·640	3681	13059	2·04	2·40	2·94	3·77	..	..
412	·638	3672	13028	2·03	2·40	2·93	3·77	..	..
411	·637	3663	12996	2·03	2·40	2·93	3·76	..	..
410	·635	3654	12965	2·03	2·40	2·93	3·76	..	..
409	·633	3645	12933	2·03	2·39	2·92	3·75	..	..
408	·632	2636	12901	2·02	2·39	2·92	3·75	..	..
407	·630	3627	12870	2·02	2·39	2·91	3·74	..	..
406	·629	3618	12838	2·02	2·38	2·91	3·74	..	..
405	·627	3609	12807	2·02	2·38	2·91	3·73	..	..
404	·626	3600	12775	2·01	2·38	2·90	3·73	..	..
403	·624	3592	12743	2·01	2·37	2·90	3·72	..	..
402	·623	3583	12712	2·01	2·37	2·90	3·72	..	..
401	·621	3574	12680	2·00	2·37	2·89	3·71	..	..
400	·620	3565	12648	2·00	2·37	2·89	3·71	..	..
399	·618	3556	12617	2·00	2·36	2·89	3·71	..	..
398	·616	3546	12585	2·00	2·36	2·88	3·70	..	..
397	·615	3538	12553	2·00	2·36	2·88	3·70	..	..
396	·613	3529	12522	1·99	2·35	2·88	3·69	..	..
395	·612	3520	12490	1·99	2·35	2·87	3·69	..	..
394	·610	3511	12459	1·99	2·35	2·87	3·68	..	..
393	·609	3502	12427	1·98	2·35	2·86	3·68	..	..
392	·607	3494	12395	1·98	2·34	2·86	3·67	..	..
391	·606	3485	12364	1·98	2·34	2·86	3·67	..	..
390	·604	3476	12332	1·98	2·34	2·85	3·67	..	..
389	·602	3467	12301	1·97	2·33	2·85	3·66	..	..
388	·601	3458	12269	1·97	2·33	2·85	3·66	..	..
387	·599	3449	12238	1·97	2·33	2·84	3·65	..	..
386	·598	3440	12206	1·97	2·32	2·84	3·65	..	..
385	·596	3431	12174	1·96	2·32	2·83	3·64	..	..
384	·595	3422	12143	1·96	2·32	2·83	3·64	..	..
383	·593	3413	12111	1·96	2·31	2·83	3·63	..	..
382	·592	3404	12080	1·96	2·31	2·82	3·63	..	..
381	·590	3396	12048	1·95	2·31	2·82	3·62	..	..
380	·589	3387	12016	1·95	2·30	2·82	3·62	..	..
379	·587	3378	11985	1·95	2·30	2·81	3·61	..	..
378	·585	3369	11953	1·95	2·30	2·81	3·61	..	..
377	·584	3360	11921	1·94	2·30	2·81	3·60	..	..
376	·582	3351	11890	1·94	2·29	2·80	3·60	..	..
375	·581	3342	11858	1·94	2·29	2·80	3·59	..	..
374	·579	3333	11827	1·94	2·29	2·79	3·59	..	..
373	·578	3324	11795	1·93	2·28	2·79	3·58	..	..
372	·576	3315	11763	1·93	2·28	2·79	3·58	..	..
371	·575	3306	11732	1·93	2·28	2·78	3·57	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
370	0·573	3297	11700	1·93	2·28	2·78	3·57	..	..
369	·571	3289	11668	1·92	2·27	2·77	3·56	..	..
368	·570	3280	11636	1·92	2·27	2·77	3·56	..	..
367	·568	3271	11605	1·92	2·27	2·77	3·55	..	..
366	·567	3262	11573	1·92	2·26	2·76	3·55	..	..
365	·565	3253	11541	1·91	2·26	2·76	3·54	..	..
364	·564	3243	11510	1·91	2·26	2·76	3·54	..	..
363	·562	3235	11478	1·91	2·25	2·75	3·53	..	..
362	·561	3226	11447	1·90	2·25	2·75	3·53	..	..
361	·559	3217	11415	1·90	2·25	2·75	3·52	..	..
360	·558	3208	11383	1·90	2·24	2·74	3·52	..	..
359	·556	3199	11352	1·90	2·24	2·74	3·51	..	..
358	·554	3191	11320	1·90	2·24	2·73	3·51	..	..
357	·553	3182	11288	1·89	2·24	2·73	3·50	..	..
356	·551	3173	11257	1·89	2·23	2·73	3·50	..	..
355	·550	3164	11225	1·89	2·23	2·72	3·50	..	..
354	·548	3155	11194	1·89	2·23	2·72	3·49	..	..
353	·547	3146	11162	1·88	2·22	2·71	3·49	..	..
352	·545	3137	11130	1·88	2·22	2·71	3·48	..	..
351	·544	3128	11099	1·88	2·22	2·71	3·48	..	..
350	·542	3119	11067	1·87	2·21	2·70	3·47	..	..
349	·540	3110	11035	1·87	2·21	2·70	3·46	..	..
348	·539	3101	11004	1·87	2·21	2·69	3·46	..	..
347	·537	3093	10972	1·86	2·20	2·69	3·46	..	..
346	·536	3084	10940	1·86	2·20	2·69	3·45	..	..
345	·534	3075	10909	1·86	2·20	2·68	3·45	..	..
344	·533	3066	10877	1·86	2·19	2·68	3·44	..	..
343	·531	3057	10846	1·85	2·19	2·68	3·44	..	..
342	·530	3048	10814	1·85	2·19	2·67	3·43	..	..
341	·528	3038	10783	1·85	2·18	2·67	3·43	..	..
340	·527	3030	10751	1·85	2·18	2·67	3·42	..	..
339	·525	3021	10719	1·84	2·18	2·66	3·42	..	..
338	·523	3012	10688	1·84	2·17	2·66	3·41	..	..
337	·522	3003	10656	1·84	2·17	2·66	3·41	..	..
336	·520	2994	10624	1·84	2·17	2·65	3·40	..	..
335	·519	2986	10593	1·83	2·17	2·65	3·40	..	..
334	·517	2977	10561	1·83	2·16	2·64	3·39	..	..
333	·516	2968	10530	1·83	2·16	2·64	3·39	..	..
332	·514	2959	10498	1·82	2·16	2·63	3·38	..	..
331	·513	2950	10466	1·82	2·15	2·63	3·37	..	..
330	·511	2941	10435	1·82	2·15	2·62	3·37	..	..
329	·509	2932	10403	1·82	2·15	2·62	3·36	..	..
328	·508	2923	10371	1·81	2·14	2·62	3·36	..	..
327	·506	2914	10340	1·81	2·14	2·61	3·35	..	..
326	·505	2905	10308	1·81	2·14	2·61	3·35	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
325	0·503	2896	10277	1·81	2·13	2·61	3·34	..	..
324	·502	2888	10245	1·80	2·13	2·60	3·34	..	..
323	·500	2879	10213	1·80	2·13	2·60	3·33	..	..
322	·499	2870	10181	1·80	2·12	2·59	3·33	..	..
321	·497	2861	10150	1·79	2·12	2·59	3·32	..	..
320	·496	2852	10118	1·79	2·12	2·58	3·32	..	..
319	·494	2843	10086	1·79	2·11	2·58	3·31	..	..
318	·492	2834	10055	1·79	2·11	2·58	3·31	..	..
317	·491	2825	10023	1·78	2·11	2·57	3·30	..	..
316	·489	2816	9991	1·78	2·10	2·57	3·30	..	..
315	·488	2807	9959	1·78	2·10	2·56	3·29	..	..
314	·486	2798	9928	1·77	2·10	2·56	3·29	..	..
313	·485	2789	9896	1·77	2·09	2·56	3·28	..	..
312	·483	2781	9865	1·77	2·09	2·55	3·28	..	..
311	·482	2772	9833	1·77	2·09	2·55	3·27	..	..
310	·480	2763	9802	1·76	2·08	2·54	3·26	..	..
309	·478	2754	9770	1·76	2·08	2·54	3·26	..	..
308	·477	2745	9739	1·76	2·08	2·54	3·26	..	..
307	·475	2735	9707	1·75	2·07	2·53	3·25	..	..
306	·474	2727	9676	1·75	2·07	2·53	3·24	..	..
305	·472	2718	9644	1·75	2·07	2·52	3·24	..	..
304	·471	2709	9612	1·75	2·06	2·52	3·23	..	..
303	·469	2700	9581	1·74	2·06	2·51	3·23	..	..
302	·468	2691	9549	1·74	2·06	2·51	3·22	..	..
301	·466	2683	9517	1·74	2·05	2·51	3·22	..	..
300	·465	2674	9486	1·74	2·05	2·50	3·21	..	..
299	·463	2665	9454	1·73	2·05	2·50	3·21	..	..
298	·461	2656	9423	1·73	2·04	2·50	3·20	..	..
297	·460	2647	9391	1·73	2·04	2·49	3·20	..	..
296	·458	2638	9360	1·72	2·04	2·49	3·19	..	..
295	·457	2629	9328	1·72	2·03	2·48	3·19	..	..
294	·455	2620	9296	1·72	2·03	2·48	3·18	..	..
293	·454	2611	9265	1·71	2·02	2·47	3·18	..	..
292	·452	2602	9233	1·71	2·02	2·47	3·17	..	..
291	·451	2593	9201	1·71	2·02	2·46	3·16	..	..
290	·449	2585	9170	1·71	2·01	2·46	3·16	..	..
289	·447	2576	9138	1·70	2·01	2·46	3·15	..	..
288	·446	2567	9107	1·70	2·01	2·45	3·15	..	..
287	·444	2558	9075	1·70	2·00	2·45	3·14	..	..
286	·443	2549	9043	1·69	2·00	2·44	3·14	..	..
285	·441	2540	9012	1·69	2·00	2·44	3·13	..	..
284	·440	2531	8980	1·69	1·99	2·43	3·13	..	..
283	·438	2522	8948	1·68	1·99	2·43	3·12	..	..
282	·437	2513	8917	1·68	1·99	2·43	3·12	..	..
281	·435	2504	8885	1·68	1·98	2·42	3·11	..	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.[2]	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
280	0·434	2495	8853	1·68	1·98	2·42	3·10	..	..
279	·432	2486	8822	1·67	1·98	2·41	3·10	..	..
278	·430	2478	8790	1·67	1·97	2·41	3·09	..	..
277	·429	2469	8759	1·67	1·97	2·40	3·09	..	..
276	·427	2460	8727	1·66	1·97	2·40	3·08	..	..
275	·426	2451	8695	1·66	1·96	2·40	3·08	..	..
274	·424	2442	8664	1·66	1·96	2·39	3·07	..	..
273	·423	2433	8632	1·65	1·95	2·39	3·06	..	..
272	·421	2424	8601	1·65	1·95	2·38	3·06	..	..
271	·420	2415	8569	1·65	1·95	2·38	3·05	..	..
270	·418	2406	8537	1·65	1·94	2·37	3·05	..	..
269	·416	2397	8506	1·64	1·94	2·37	3·04	..	..
268	·415	2388	8474	1·64	1·94	2·37	3·04	..	..
267	·413	2380	8443	1·64	1·93	2·36	3·03	..	..
266	·412	2371	8411	1·63	1·93	2·36	3·03	..	..
265	·410	2362	8379	1·63	1·93	2·35	3·02	4·21	..
264	·409	2353	8348	1 63	1·92	2·35	3·01	4·21	..
263	·407	2344	8316	1·62	1·92	2·34	3·01	4·20	..
262	·406	2335	8285	1·62	1·91	2·34	3·00	4·19	..
261	·404	2326	8253	1·62	1·91	2·33	3·00	4·18	..
260	·403	2317	8221	1·61	1·91	2·33	2·99	4·17	..
259	·401	2308	8190	1·61	1·90	2·32	2·99	4·17	..
258	·399	2299	8158	1·61	1·90	2·32	2·98	4·16	..
257	·398	2290	8127	1·61	1·90	2·32	2·97	4·15	..
256	·396	2282	8095	1·60	1·89	2·31	2·97	4·14	..
255	·395	2273	8063	1·60	1·89	2·31	2·96	4·13	..
254	·393	2264	8032	1·60	1·89	2·30	2·96	4·13	..
253	·392	2255	8000	1·59	1·88	2·30	2·95	4·12	..
252	·390	2246	7968	1·59	1·88	2·29	2·94	4·11	..
251	·389	2237	7937	1·59	1·87	2·29	2·94	4·10	..
250	·387	2228	7905	1·58	1·87	2·28	2·93	4·09	..
249	·385	2219	7873	1·58	1·87	2·28	2·93	4·08	..
248	·384	2210	7842	1·58	1·86	2·28	2·92	4·08	..
247	·382	2201	7810	1·57	1·86	2·27	2·91	4·07	..
246	·381	2192	7778	1·57	1·86	2·27	2·91	4·06	..
245	·379	2183	7747	1·57	1·85	2·26	2·90	4·05	..
244	·378	2175	7715	1·56	1·85	2·26	2·90	4·04	..
243	·376	2166	7683	1·56	1·85	2·25	2·89	4·04	..
242	·375	2157	7652	1·56	1·84	2·25	2·89	4·03	..
241	·373	2148	7620	1·55	1·84	2·24	2·88	4·02	..
240	·372	2139	7588	1·55	1·83	2·24	2·87	4·01	..
239	·370	2130	7557	1·55	1·83	2·23	2·87	4·00	..
238	·368	2121	7525	1·55	1·82	2·23	2·86	3·99	..
237	·367	2112	7493	1·54	1·82	2·23	2·86	3·99	..
236	·365	2103	7462	1·54	1·82	2·22	2·85	3·98	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
235	0·364	2094	7430	1·54	1·81	2·22	2·84	3·97	..
234	·362	2085	7399	1·53	1·81	2·21	2·84	3·96	..
233	·361	2077	7367	1·53	1·81	2·21	2·83	3·95	..
232	·359	2068	7335	1·53	1·80	2·20	2·83	3·94	..
231	·358	2059	7304	1·52	1·80	2·20	2·82	3·93	..
230	·356	2050	7272	1·52	1·79	2·19	2·82	3·93	..
229	·354	2041	7240	1·52	1·79	2·19	2·81	3·92	..
228	·353	2032	7209	1·51	1·79	2·18	2·80	3·91	..
227	·351	2023	7177	1·51	1·78	2·18	2·79	3·90	..
226	·350	2014	7145	1·50	1·78	2·17	2·79	3·89	..
225	·348	2005	7114	1·50	1·77	2·17	2·78	3·88	..
224	·347	1996	7082	1·50	1·77	2·16	2·78	3·87	..
223	·345	1987	7050	1·49	1·77	2·16	2·77	3·87	..
222	·344	1979	7019	1·49	1·76	2·15	2·76	3·86	..
221	·342	1970	6987	1·49	1·76	2·15	2·76	3·85	..
220	·341	1961	6956	1·48	1·76	2·14	2·75	3·84	..
219	·339	1952	6924	1·48	1·75	2·14	2·75	3·83	..
218	·337	1943	6892	1·48	1·75	2·13	2·74	3·82	..
217	·336	1934	6861	1·47	1·74	2·13	2·73	3·81	..
216	·334	1925	6829	1·47	1·74	2·12	2·73	3·80	..
215	·333	1916	6797	1·47	1·73	2·12	2·72	3·80	..
214	·331	1907	6766	1·46	1·73	2·11	2·71	3·79	..
213	·330	1898	6734	1·46	1·73	2·11	2·71	3·78	..
212	·328	1889	6703	1·46	1·72	2·10	2·70	3·77	..
211	·327	1880	6671	1·45	1·72	2·10	2·69	3·76	..
210	·325	1872	6640	1·45	1·71	2·09	2·69	3·75	..
209	·323	1863	6608	1·45	1·71	2·09	2·68	3·74	..
208	·322	1854	6577	1·44	1·71	2·08	2·68	3·73	..
207	·320	1845	6545	1·44	1·70	2·08	2·67	3·72	..
206	·319	1836	6513	1·44	1·70	2·07	2·66	3·72	..
205	·317	1827	6482	1·43	1·69	2·07	2·66	3·71	..
204	·316	1818	6450	1·43	1·69	2·06	2·65	3·70	..
203	·314	1809	6418	1·43	1·69	2·06	2·64	3·69	..
202	·313	1800	6387	1·42	1·68	2·05	2·64	3·68	..
201	·311	1791	6355	1·42	1·68	2·05	2·63	3·67	..
200	·310	1782	6324	1·42	1·67	2·04	2·62	3·66	..
199	·308	1774	6292	1·41	1·67	2·04	2·62	3·65	..
198	·306	1765	6260	1·41	1·67	2·03	2·61	3·64	..
197	·305	1756	6229	1·41	1·66	2·03	2·60	3·63	..
196	·303	1747	6197	1·40	1·66	2·02	2·60	3·62	..
195	·302	1738	6165	1·40	1·65	2·02	2·59	3·62	..
194	·300	1729	6134	1·39	1·65	2·01	2·58	3·61	..
193	·299	1720	6102	1·39	1·65	2·01	2·58	3·60	..
192	·297	1711	6071	1·39	1·64	2·00	2·57	3·59	..
191	·296	1702	6039	1·38	1·64	2·00	2·56	3·58	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
190	0·294	1693	6008	1·38	1·63	1·99	2·56	3·57	..
189	·292	1684	5976	1·38	1·63	1·99	2·55	3·56	..
188	·291	1675	5945	1·37	1·62	1·98	2·54	3·55	..
187	·289	1667	5913	1·37	1·62	1·98	2·54	3·54	..
186	·288	1658	5881	1·36	1·61	1·97	2·53	3·53	..
185	·286	1649	5850	1·36	1·61	1·96	2·52	3·52	..
184	·285	1640	5818	1·36	1·60	1·96	2·52	3·51	..
183	·283	1631	5786	1·35	1·60	1·95	2·51	3·50	..
182	·282	1622	5755	1·35	1·60	1·95	2·50	3·49	..
181	·280	1613	5723	1·35	1·59	1·94	2·50	3·48	..
180	·279	1604	5691	1·34	1·59	1·94	2·49	3·47	..
179	·277	1595	5660	1·34	1·58	1·93	2·48	3·46	..
178	·275	1586	5628	1·34	1·58	1·93	2·48	3·45	..
177	·274	1577	5596	1·33	1·57	1·92	2·47	3·44	..
176	·272	1569	5565	1·33	1·57	1·92	2·46	3·43	..
175	·271	1560	5533	1·32	1·56	1·91	2·45	3·43	..
174	·269	1551	5501	1·32	1·56	1·91	2·45	3·42	..
173	·268	1542	5470	1·32	1·56	1·90	2·44	3·41	..
172	·266	1533	5438	1·31	1·55	1·90	2·43	3·40	..
171	·265	1524	5406	1·31	1·55	1·89	2·43	3·39	..
170	·263	1515	5375	1·31	1·54	1·88	2·42	3·38	..
169	·261	1506	5343	1·30	1·54	1·88	2·41	3·37	..
168	·260	1497	5311	1·30	1·53	1·87	2·40	3·36	..
167	·258	1488	5280	1·29	1·53	1·87	2·40	3·35	..
166	·257	1479	5248	1·29	1·52	1·86	2·39	3·34	..
165	·255	1471	5217	1·29	1·52	1·86	2·38	3·33	..
164	·254	1462	5185	1·28	1·52	1·85	2·38	3·32	..
163	·252	1453	5153	1·28	1·51	1·84	2·37	3·31	..
162	·251	1444	5122	1·27	1·51	1·84	2·36	3·29	..
161	·249	1435	5090	1·27	1·50	1·83	2·35	3·28	..
160	·248	1426	5059	1·27	1·50	1·83	2·35	3·27	..
159	·246	1417	5027	1·26	1·49	1·82	2·34	3·26	..
158	·244	1408	4996	1·26	1·49	1·82	2·33	3·25	..
157	·243	1399	4964	1·26	1·48	1·81	2·32	3·24	..
156	·241	1390	4932	1·25	1·48	1·80	2·32	3·23	..
155	·240	1381	4901	1·25	1·47	1·80	2·31	3·22	..
154	·238	1372	4869	1·24	1·47	1·79	2·30	3·21	..
153	·237	1364	4838	1·24	1·46	1·79	2·29	3·20	..
152	·235	1355	4806	1·24	1·46	1·78	2·29	3·19	..
151	·234	1346	4774	1·23	1·45	1·78	2·28	3·18	..
150	·232	1337	4742	1·23	1·45	1·77	2·27	3·17	..
149	·230	1328	4711	1·22	1·44	1·76	2·27	3·16	..
148	·229	1319	4679	1·22	1·44	1·76	2·26	3·15	..
147	·227	1310	4647	1·21	1·43	1·75	2·25	3·14	..
146	·226	1301	4616	1·21	1·43	1·75	2·24	3·13	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
145	0·224	1292	4584	1·21	1·42	1·74	2·23	3·12	..
144	·223	1283	4553	1·20	1·42	1·73	2·23	3·11	..
143	·221	1274	4521	1·20	1·41	1·73	2·22	3·10	..
142	·220	1266	4490	1·19	1·41	1·72	2·21	3·08	..
141	·218	1257	4458	1·19	1·40	1·72	2·20	3·07	..
140	·217	1248	4427	1·19	1·40	1·71	2·19	3·06	..
139	·215	1239	4395	1·18	1·39	1·71	2·19	3·05	..
138	·213	1230	4364	1·18	1·39	1·70	2·18	3·04	..
137	·212	1221	4332	1·17	1·38	1·69	2·17	3·03	..
136	·210	1212	4300	1·17	1·38	1·69	2·16	3·02	..
135	·209	1203	4269	1·16	1·37	1·68	2·16	3·01	..
134	·207	1194	4237	1·16	1·37	1·67	2·15	3·00	..
133	·206	1185	4206	1·16	1·36	1·67	2·14	2·99	..
132	·204	1176	4174	1·15	1·36	1·66	2·13	2·97	..
131	·203	1168	4142	1·15	1·35	1·65	2·12	2·96	..
130	·201	1159	4110	1·14	1·35	1·65	2·12	2·95	..
129	·199	1150	4079	1·14	1·34	1·64	2·11	2·94	..
128	·198	1141	4047	1·13	1·34	1·63	2·10	2·93	..
127	·196	1132	4016	1·13	1·33	1·63	2·09	2·92	..
126	·195	1123	3984	1·12	1·33	1·62	2·08	2·91	..
125	·193	1114	3952	1·12	1·32	1·62	2·07	2·89	..
124	·192	1105	3921	1·11	1·32	1·61	2·07	2·88	..
123	·190	1096	3889	1·11	1·31	1·60	2·06	2·87	..
122	·189	1087	3857	1·11	1·31	1·60	2·05	2·86	..
121	·187	1078	3826	1·10	1·30	1·59	2·04	2·85	..
120	·186	1069	3794	1·10	1·30	1·58	2·03	2·84	..
119	·184	1061	3762	1·09	1·29	1·58	2·02	2·82	..
118	·182	1052	3731	1·09	1·28	1·57	2·02	2·81	..
117	·181	1043	3699	1·08	1·28	1·56	2·01	2·80	..
116	·179	1034	3668	1·08	1·27	1·56	2·00	2·79	..
115	·178	1025	3636	1·07	1·27	1·55	1·99	2·78	..
114	·176	1016	3604	1·07	1·26	1·54	1·98	2·76	..
113	·175	1007	3573	1·06	1·26	1·54	1·97	2·75	..
112	·173	998	3541	1·06	1·25	1·53	1·96	2·74	..
111	·172	989	3509	1·05	1·25	1·52	1·95	2·73	..
110	·170	980	3478	1·05	1·24	1·52	1·95	2·72	..
109	·168	971	3446	1·05	1·23	1·51	1·94	2·70	..
108	·167	963	3414	1·04	1·23	1·50	1·93	2·69	..
107	·165	954	3383	1·04	1·22	1·50	1·92	2·68	..
106	·164	945	3351	1·03	1·22	1·49	1·91	2·67	..
105	·162	936	3319	1·03	1·21	1·48	1·90	2·65	..
104	·161	927	3288	1·02	1·21	1·47	1·89	2·64	..
103	·159	918	3256	1·02	1·20	1·47	1·88	2·63	..
102	·158	909	3224	1·01	1·20	1·46	1·87	2·61	..
101	·156	900	3193	1·01	1·19	1·45	1·86	2·60	..

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
100	0·155	891	3162	1·000	1·18	1·44	1·86	2·59	..
99	·153	882	3130	0·996	1·18	1·44	1·85	2·58	..
98	·151	873	3098	·991	1·17	1·43	1·84	2·56	4·22
97	·150	865	3067	·986	1·17	1·42	1·83	2·55	4·20
96	·148	856	3035	·981	1·16	1·41	1·82	2·54	4·18
95	·147	847	3004	·976	1·15	1·41	1·81	2·52	4·16
94	·145	838	2972	·971	1·15	1·40	1·80	2·51	4·13
93	·144	829	2940	·965	1·14	1·39	1·79	2·50	4·11
92	·142	820	2909	·960	1·13	1·39	1·78	2·48	4·09
91	·141	811	2877	·955	1·13	1·38	1·77	2·47	4·07
90	·139	802	2846	·949	1·12	1·37	1·76	2·46	4·05
89	·137	793	2814	·944	1·12	1·36	1·75	2·44	4·02
88	·136	784	2783	·939	1·11	1·36	1·74	2·43	4·00
87	·134	775	2751	·934	1·10	1·35	1·73	2·41	3·98
86	·133	766	2719	·928	1·10	1·34	1·72	2·40	3·96
85	·131	758	2688	·923	1·09	1·33	1·71	2·39	3·93
84	·130	749	2656	·917	1·08	1·32	1·70	2·37	3·91
83	·128	740	2625	·912	1·07	1·32	1·69	2·36	3·88
82	·127	731	2593	·906	1·07	1·31	1·68	2·34	3·86
81	·125	722	2561	·901	1·06	1·30	1·67	2·33	3·84
80	·124	713	2530	·895	1·06	1·29	1·66	2·32	3·81
79	·122	704	2498	·890	1·05	1·28	1·65	2·30	3·79
78	·120	695	2467	·884	1·05	1·28	1·64	2·29	3·77
77	·119	686	2435	·878	1·04	1·27	1·63	2·27	3·74
76	·117	677	2404	·873	1·03	1·26	1·62	2·26	3·72
75	·116	668	2372	·867	1·02	1·25	1·61	2·24	3·69
74	·114	660	2341	·861	1·02	1·24	1·60	2·23	3·67
73	·113	651	2309	·855	1·01	1·23	1·59	2·21	3·64
72	·111	642	2277	·849	1·00	1·23	1·57	2·20	3·62
71	·110	633	2246	·844	0·996	1·22	1·56	2·18	3·59
70	·1085	624	2214	·838	·990	1·21	1·55	2·17	3·57
69	·1069	615	2182	·832	·982	1·20	1·54	2·15	3·54
68	·1054	606	2151	·824	·976	1·19	1·53	2·13	3·52
67	·1038	597	2119	·819	·968	1·18	1·52	2·12	3·49
66	·1023	588	2088	·813	·961	1·17	1·51	2·10	3·46
65	·1007	579	2056	·807	·953	1·16	1·50	2·09	3·44
64	·0992	570	2024	·800	·946	1·16	1·48	2·07	3·41
63	·0976	561	1993	·795	·939	1·15	1·47	2·06	3·39
62	·0961	553	1961	..	·930	1·14	1·46	2·04	3·36
61	·0945	544	1929	..	·924	1·13	1·45	2·02	3·33
60	·0930	535	1897	..	·916	1·12	1·44	2·01	3·30
59	·0914	526	1866	..	·908	1·11	1·42	1·99	3·28
58	·0899	517	1834	..	·901	1·10	1·41	1·97	3·25
57	·0883	508	1803	..	·893	1·09	1·40	1·95	3·22
56	·0868	499	1771	..	·885	1·08	1·39	1·94	3·19

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
55	0·0852	490	1739	..	0·874	1·07	1·37	1·92	3·16
54	·0837	481	1708	..	·869	1·06	1·36	1·90	3·13
53	·0821	472	1676	..	·860	1·05	1·35	1·88	3·10
52	·0806	463	1644	..	·853	1·04	1·34	1·87	3·08
51	·0790	455	1612·7	..	·845	1·03	1·32	1·85	3·05
50	·0775	446	1581·0	..	·836	1·02	1·31	1·83	3·02
49	·0759	437	1549·3	..	·828	1·01	1·30	1·81	2·99
48	·0744	428	1517·6	..	·819	1·00	1·29	1·79	2·95
47	·0728	419	1486·2	..	·810	0·990	1·27	1·78	2·92
46	·0713	410	1454·5	..	·800	·980	1·26	1·76	2·89
45	·0697	401	1423·0	..	..	·969	1·24	1·74	2·86
44	·0682	392	1391·3	..	..	·958	1·23	1·72	2·83
43	·0666	383	1359·7	..	..	·948	1·22	1·70	2·80
42	·0651	374	1328·0	..	..	·936	1·20	1·68	2·77
41	·0635	365	1296·5	..	..	·925	1·19	1·66	2·73
40	·0620	356	1265·0	..	..	·914	1·17	1·64	2·70
39	·0604	348	1233·2	..	..	·902	1·16	1·62	2·66
38	·0589	339	1201·6	..	..	·891	1·14	1·60	2·63
37	·0573	330	1170·0	..	..	·878	1·13	1·58	2·59
36	·0558	321	1138·3	..	..	·867	1·11	1·55	2·56
35	·0542	312	1106·7	..	..	·855	1·10	1·53	2·52
34	·0527	303	1075·1	..	..	·842	1·08	1·51	2·48
33	·0511	294	1043·5	..	..	·830	1·07	1·49	2·45
32	·0496	285	1011·8	..	..	·818	1·05	1·46	2·41
31	·0480	276	980·2	..	..	·804	1·03	1·44	2·37
30	·0465	267	948·8	..	..	·792	1·02	1·42	2·34
29	·0449	258	917·0	..	..	..	0·999	1·39	2·30
28	·0434	250	885·3	..	..	..	·982	1·37	2·26
27	·0418	241	853·7	..	..	..	·964	1·35	2·21
26	·0403	232	822·1	..	..	..	·947	1·32	2·18
25	·0387	223	790·5	..	..	..	·928	1·29	2·13
24	·0372	214	758·8	..	..	..	·909	1·27	2·09
23	·0356	205	727·2	..	..	..	·890	1·24	2·04
22	·0341	196	695·6	..	..	..	·870	1·21	2·00
21	·0325	187	664·0	..	..	..	·850	1·19	1·96
20	·0310	178	632·4	..	..	..	·830	1·16	1·91
19	·0294	169	600·8	..	..	..	·808	1·13	1·86
18	·0279	160	569·1	..	..	..	·787	1·10	1·81
17	·0263	152	537·5	..	..	..	..	1·07	1·76
16	·0248	143	505·9	..	..	..	..	1·04	1·71
15	·0232	134	474·2	..	..	..	..	1·00	1·65
14	·0217	125	442·7	..	..	..	..	0·969	1·60
13	·0201	116	411·0	..	..	..	..	·933	1·54
12	·0186	107	379·4	..	..	..	..	·896	1·48
11	·0170	98	347·8	..	..	..	..	·859	1·41

TABLE No. 2.—COPPER STRANDS—*continued.*

Cross Section		Weight of Copper		Strand (Diameters in mm.)					
mm.²	sq. in.	Kilog. per km.	lb. per mile	127	91	61	37	19	7
10	0·0155	89	316·2	..	..	..	..	0·818	1·35
9	·0139	80	284·6	..	..	..	..	·777	1·28
8	·0124	71	253·0	..	..	..	..	..	1·21
7	·0108	62	221·4	..	..	..	..	..	1·07
6	·0093	53	189·7	..	..	..	..	..	1·05
5	·00775	45	158·1	..	..	..	..	..	0·954
4	·0062	36	126·5	..	..	..	..	..	·853
3	·00465	27	94·9	..	..	..	..	..	·738
2	·0031	18	63·2	..	..	..	..	..	..
1	·00155	9	31·6	..	..	..	..	..	..

Conversion of mm. to inches, multiply mm. by 0·03937.

Diameter of Strand.—Table 3 gives the pitch and overall diameters of the standard strands, taking the diameter of the wire composing the strand as unity. These constants multiplied by the diameter of the wire give the diameters of the strand.

TABLE No. 3.—DIAMETERS OF STRANDS.

Number of Wires in Strand	Pitch Diameter of Strand	Overall Diameter of Strand
3	1·1547	2·1547
4	1·414	2·414
7	2·0	3·0
19	4·0	5·0
37	6·0	7·0
61	8·0	9·0
91	10·0	11·0
127	12·0	13·0

The Pitch Diameter is twice the distance between the centre of the strand and the centre of any wire forming the outside layer.

The Overall Diameter is, of course, the maximum diameter of the strand, and is equal to the pitch diameter plus the diameter of the wire.

Lay.—The length of lay of the wire in any layer is generally considered as a multiple of the pitch diameter of the strand. The standard length of lay adopted by the Cable Makers' Association is twenty times the pitch diameter, but in special cases this would be increased or decreased as required.

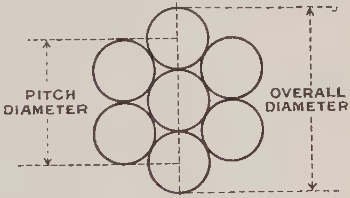


FIG. 1.

The extra length of wire required in a strand can be calculated in the following way :—

FIG. 2.

In Fig. 2, let d = the pitch diameter of the strand

l = the length of lay

a = the ratio $\frac{l}{d}$

x = actual length of any wire in the strand,

then the lengths (πd), l and x form a right-angled triangle, with x as hypotenuse.

$$\therefore \quad x = \sqrt{l^2 + (\pi d)^2} = \sqrt{(a d)^2 + (\pi d)^2}.$$
$$= d\sqrt{a^2 + \pi^2}.$$

Therefore, the increment of length of wire on account of the lay per unit length of strand is equal to

$$\lambda = \frac{x - l}{l} = \frac{d\sqrt{a^2 + \pi^2} - a d}{a d} = \frac{\sqrt{a^2 + \pi^2}}{a} - 1.$$

The sine of the angle of lay is equal to $\frac{l}{x}$.

$$\frac{l}{x} = \frac{a d}{d\sqrt{a^2 + \pi^2}} = \frac{a}{\sqrt{a^2 + \pi^2}}.$$

Table 4 shows the percentage of weight or length to be added to that of a straight wire of length equal to the axial length of the strand, to compensate for the lay.

TABLE NO. 4.—HELICAL LAY.

Ratio of Pitch Diameter to length of Lay	Angle of Lay	Per cent. to be added	Ratio of Pitch Diameter to length of Lay	Angle of Lay	Per cent. to be added	Ratio of Pitch Diameter to length of Lay	Angle of Lay	Per cent. to be added
1·0	17° 40′	229·8	3·7	49° 40′	31·2	8·0	68° 35′	7·44
1·1	19 20	202·6	3·8	50 27	29·7	8·5	69 45	6·60
1·2	20 50	180·2	3·9	51 9	28·4	9·0	70 46	5·92
1·3	22 30	161·5	4·0	51 50	27·5	9·5	71 25	5·50
1·4	24 0	145·7	4·1	52 31	26·0	10·0	72 35	4·82
1·5	25 30	132·1	4·2	53 19	24·7	11	73 59	4·04
1·6	27 0	120·4	4·3	53 53	23·8	12	75 21	3·37
1·7	28 25	110·1	4·4	54 28	22·9	13	76 25	2·88
1·8	29 50	101·1	4·5	55 3	22·0	14	77 22	2·48
1·9	31 10	93·2	4·6	55 39	21·1	15	78 15	2·17
2·0	32 35	86·2	4·7	56 13	20·3	16	78 52	1·91
2·1	33 45	79·9	4·8	56 49	19·5	17	79 33	1·69
2·2	35 0	74·3	4·9	57 21	18·8	18	80 5	1·51
2·3	36 10	69·3	5·0	57 52	18·1	19	80 39	1·35
2·4	37 25	64·8	5·1	58 20	17·5	20	81 3	1·226
2·5	38 35	60·6	5·2	58 54	16·8	21	81 28	1·113
2·6	39 35	56·8	5·3	59 18	16·3	22	81 52	1·012
2·7	40 40	53·4	5·4	59 48	15·7	23	82 16	0·919
2·8	41 40	50·3	5·5	60 19	15·1	24	82 31	·853
2·9	42 40	47·4	5·6	60 40	14·7	25	82 50	·787
3·0	43 40	44·8	5·7	61 8	14·2	26	83 7	·727
3·1	44 35	42·4	5·8	61 36	13·7	27	83 19	·675
3·2	45 33	40·1	5·9	61 58	13·3	28	83 34	·628
3·3	46 26	38·0	6·0	62 23	12·88	29	83 46	·585
3·4	47 15	36·2	6·5	64 17	11·0	30	84 3	·542
3·5	48 5	34·4	7·0	65 51	9·6			
3·6	48 54	32·7	7·5	67 19	8·4			

The following constants are calculated, taking a lay of twenty times the pitch diameter as adopted by the C.M.A.

Resistance of 3 strand cable	= 0·33742	×	resistance of single wire of length equal to the axial length of strand
" 4 " "	= 0·253065	×	" " "
" 7 " "	= 0·1443557	×	" " "
" 19 " "	= 0·0532424	×	" " "
" 37 " "	= 0·0273493	×	" " "
" 61 " "	= 0·0165911	×	" " "
" 91 " "	= 0·0111222	×	" " "
" 127 " "	= 0·00796978	×	" " "

Weight of 3 strand cable	= 3·03678	×	weight of single wire of length equal to the axial length of strand
" 4 " "	= 4·04904	×	" " "
" 7 " "	= 7·07356	×	" " "
" 19 " "	= 19·2207	×	" " "
" 37 " "	= 37·4414	×	" " "
" 61 " "	= 61·7356	×	" " "
" 91 " "	= 92·1034	×	" " "
" 127 " "	= 128·5447	×	" " "

Effectual area of 3 strand cable	= 2·96366	×	area of single wire.
" " 4 " "	= 3·95155	×	" " "
" " 7 " "	= 6·92733	×	" " "
" " 19 " "	= 18·7820	×	" " "
" " 37 " "	= 36·5640	×	" " "
" " 61 " "	= 60·2733	×	" " "
" " 91 " "	= 89·9100	×	" " "
" " 127 " "	= 125·4740	×	" " "

The Engineering Standards Committee have since standardised an increase of 2 per cent. on account of lay, in all wires except the centre wire, which corresponds to a lay of approximately 15·5 times the pitch diameter. The following constants are calculated on this allowance :—

Resistance of 3 strand cable	= 0·34000	×	resistance of single wire.
" 4 " "	= 0·25500	×	" " "
" 7 " "	= 0·14530	×	" " "
" 19 " "	= 0·053628	×	" " "
" 37 " "	= 0·027553	×	" " "
" 61 " "	= 0·016716	×	" " "
" 91 " "	= 0·011206	×	" " "
" 127 " "	= 0·008030	×	" " "

Weight of 3 strand cable	= 3·0600	×	weight of single wire.
" 4 " "	= 4·0800	×	" " "
" 7 " "	= 7·1200	×	" " "
" 19 " "	= 19·3600	×	" " "
" 37 " "	= 37·7200	×	" " "
" 61 " "	= 62·2000	×	" " "
" 91 " "	= 92·8000	×	" " "
" 127 " "	= 129·5200	×	" " "

Effectual area of 3 strand cable	=	2·94117	×	area of single wire.
„ „ 4 „ „	=	3·92157	×	„ „ „
„ „ 7 „ „	=	6·88235	×	„ „ „
„ „ 19 „ „	=	18·64706	×	„ „ „
„ „ 37 „ „	=	36·29411	×	„ „ „
„ „ 61 „ „	=	59·82353	×	„ „ „
„ „ 91 „ „	=	89·23529	×	„ „ „
„ „ 127 „ „	=	124·5294	×	„ „ „

Effectual area of 3 strand cable	=	total calculated area	÷ 1·0200
„ „ 4 „ „	=	„ „ „	÷ 1·0200
„ „ 7 „ „	=	„ „ „	÷ 1·01714
„ „ 19 „ „	=	„ „ „	÷ 1·01895
„ „ 37 „ „	=	„ „ „	÷ 1·01946
„ „ 61 „ „	=	„ „ „	÷ 1·01967
„ „ 91 „ „	=	„ „ „	÷ 1·01978
„ „ 127 „ „	=	„ „ „	÷ 1·01984

Copper.

Copper weighs 555 lb. per cubic foot at 60° F., which gives a specific gravity of 8·90.

A 2 per cent. variation from the adopted standard weight is allowed for all conductors.

Weight in lb. per mile = 20350 × area in square inches
Weight in lb. per yard = 11·575 × area in square inches
1 cubic inch weighs 145·66 grammes.
1 cubic centimetre weighs 8·90 grammes.
Weight in kilogrammes per kilometre = 8·90 × area in mm.²
Weight in lb. per mile = 31·57 × area in mm.²

$$\text{Weight in lb. per mile} = \frac{(d \text{ in mils})^2}{62 \cdot 506}$$

Diameter in mils = $7 \cdot 906 \sqrt{\text{weight in lb. per mile.}}$

Annealed High-conductivity Commercial Copper.—A wire 1 metre long, weighing 1 gramme, and having a resistance of 0·1508 ohm at 60° F., is the standard (E.S.C.) for annealed high-conductivity commercial copper.

A 2 per cent. variation from the adopted standard of resistance is allowed in all conductors.

An allowance of 1 per cent. increased resistance, as calculated from the diameter, is allowed on all tinned copper conductors between diameters 0·104 in. and 0·028 in. (Nos. 12 to 28 S.W.G.) inclusive.

An increase of 2 per cent. in each wire, except the centre wire, is allowed in all strands, on account of lay. The average temperature coefficient of 0·00238 per degree F. (0·00428 per degree C.) is adopted by the Engineering Standards Committee for commercial purposes. This, according to the authors' opinion, is much too high for commercial copper.

The resistance per mile of annealed copper

$$= \frac{0 \cdot 0423172}{\text{area in square in.}} \text{ ohms at } 60^\circ \text{ F.}$$

The resistance per yard of annealed copper

$$= \frac{0 \cdot 000024044}{\text{area in square in.}} \text{ ohms at } 60^\circ \text{ F.}$$

The resistance per inch of annealed copper

$$= \frac{0 \cdot 0000066788}{\text{area in square in.}} \text{ ohms at } 60° \text{ F.}$$

The resistance per cubic centimetre of annealed copper = 0·00000169639 ohm at 60° F.

The resistance per mile of annealed copper

$$= \frac{862}{\text{lb. per mile}} \text{ ohms at } 60° \text{ F.}$$

The resistance per mile of annealed copper

$$= \frac{53880}{(d \text{ in mils})^2} \text{ ohms at } 60° \text{ F.}$$

Hard-drawn Copper Wire.—A wire 1 metre long, weighing 1 gramme, and having a resistance of 0·1539 ohm at 60° F., is the standard (E.S.C.) for hard-drawn, high-conductivity commercial copper.

Hard-drawn copper is defined by the Engineering Standards Committee as that which will not elongate more than 1 per cent. without fracture.

Resistance per mile of hard-drawn copper

$$= \frac{0 \cdot 0431689}{\text{area in square in.}} \text{ ohms at } 60° \text{ F.}$$

The resistance per yard of hard-drawn copper

$$= \frac{0 \cdot 0000245277}{\text{area in square in.}} \text{ ohms at } 60° \text{ F.}$$

The resistance per inch of hard-drawn copper

$$= \frac{0 \cdot 000000681327}{\text{area in square in.}} \text{ ohms at } 60° \text{ F.}$$

The resistance per cubic centimetre of hard drawn copper = 0·00000173054 ohm at 60° F.

The resistance per mile of hard drawn copper

$$= \frac{879 \cdot 35}{\text{lb. per mile}} \text{ ohms at } 60° \text{ F.}$$

The resistance per mile of hard drawn copper

$$= \frac{54964}{(\text{diameter in mils})^2} \text{ ohms at } 60° \text{ F.}$$

For paper or gutta percha insulated cables the conductor can be formed of plain copper wires, but for india rubber insulated cables the conductor should be formed of tinned copper wires.

In the case of vulcanised bitumen cables the conductor, or at least the outside layer of wires of the conductor, should be formed of tinned copper wires. If the bitumen cable has a separator of paper or jute between the conductor and the bitumen, the tinning of the conductor wires becomes unnecessary.

Copper elongates with rise of temperature 0·001718 per cent. per degree Centigrade; a length l, when raised $t°$ Centigrade in temperature, becomes:—

$$L = (1 + 0 \cdot 00001718\, t)\, l.$$

This coefficient holds good for temperatures between 0 – 100° Centigrade

Sector Conductors.—In order to reduce the diameter of multicore cables, the conductors are sometimes given a more or less sector form by one of the following methods :—

(i) The ordinary circular strand of wires, previous to being insulated, is given the required shape by passing it through a roller die.

(ii) The sector conductor is directly formed by using wires of different diameters in the centre of the strand.

(iii) The conductor is built up, in the case of a 3-core cable, on a 6-wire basis, instead of a 7-wire basis, the 6 wires being fed unstranded through a die plate so as to form the base as shown in Fig. 3. On this base of 6 wires, a further 12 wires are stranded to form an 18-wire sector conductor as shown in Fig. 4.

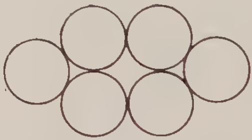


FIG. 3.—SECTOR BASIS.

The most economical sector shape—that is, a true 120° sector—cannot be adopted owing to the sharp corners, which would crack and damage the insulating material, and in the case of extra high tension cables, produce excessive

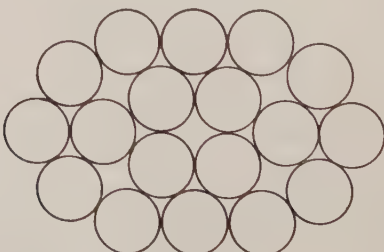


FIG. 4.—18-WIRE SECTOR CONDUCTOR.

electric stress in the dielectric. Sector conductor cables have practically no advantage when the section of the conductors is less than $0 \cdot 1$ square inch owing to the springiness of the strand.

TABLE NO. 5.—WEIGHT OF COPPER WIRE IN LB. PER NAUTICAL MILE.

Diameter		lb. per n. mile	Diameter		lb. per n. mile	Diameter		lb. per n. mile
mm.	inch		mm.	inch		mm.	inch	
0·1	0·0039	0·2857	4·7	0·1850	631·06	9·3	0·3661	2470·8
0·2	·0079	1·1427	4·8	·1890	658·20	9·4	·3701	2524·2
0·3	·0118	2·5711	4·9	·1929	685·91	9·5	·3740	2578·2
0·4	·0157	4·5708	5·0	·1968	714·19	9·6	·3780	2632·8
0·5	·0197	7 1419	5·1	·2008	743·04	9·7	·3819	2687·9
0·6	·0236	10·284	5·2	·2047	772·47	9·8	·3858	2743·6
0·7	·0276	13·998	5·3	·2087	802·46	9·9	·3898	2799·9
0·8	·0315	18·283	5·4	·2126	833·03	10·0	·3937	2856·8
0·9	·0354	23 140	5·5	·2165	864·17	10·1	·3976	2914·2
1·0	·0394	28·568	5·6	·2205	895·88	10·2	·4016	2972·2
1·1	·0433	34·567	5·7	·2244	928·16	10·3	·4055	3030·7
1·2	·0472	41·137	5·8	·2283	961·01	10·4	·4095	3089·9
1·3	·0512	48·279	5·9	·2323	994·44	10·5	·4134	3149·6
1 4	·0551	55·992	6·0	·2362	1028·4	10·6	·4173	3209·8
1·5	·0591	64·277	6·1	·2402	1063·0	10·7	·4213	3270·7
1·6	·0630	73·133	6·2	·2441	1098·1	10·8	·4252	3332·1
1·7	·0669	82·560	6·3	·2480	1133·8	10·9	·4291	3394·1
1·8	·0709	92·559	6·4	·2520	1170·1	11·0	·4331	3456·7
1·9	·0748	103·13	6·5	·2559	1207·0	11·1	·4370	3519·8
2·0	·0787	114·27	6·6	·2598	1244·4	11·2	·4409	3583·5
2·1	·0827	125·98	6·7	·2638	1282·4	11·3	·4449	3647·8
2·2	·0866	138·27	6·8	2677	1321·0	11·4	·4488	3712·6
2·3	·0905	151·12	6·9	·2717	1360·1	11·5	·4528	3778·1
2·4	·0945	164·55	7·0	·2756	1399·8	11·6	·4567	3844·0
2·5	·0984	178·55	7·1	·2795	1440·1	11·7	·4606	3910·6
2·6	·1024	193·12	7·2	·2835	1480·9	11·8	·4646	3977·7
2·7	·1063	208·26	7·3	·2874	1522·4	11·9	·4685	4045·5
2·8	·1102	223·97	7·4	·2913	1564·4	12·0	·4724	4113·7
2·9	·1142	240·25	7·5	·2953	1606·9	12·1	·4764	4182·6
3·0	·1181	257·11	7·6	·2992	1650·1	12·2	·4803	4252·1
3·1	·1220	274 53	7·7	·3031	1693·8	12·3	·4843	4322·1
3·2	·1260	292·53	7·8	·3071	1738·0	12·4	·4882	4392·6
3·3	·1299	311·10	7·9	·3110	1782·9	12·5	·4921	4463·8
3·4	·1339	330·24	8·0	·3150	1828·3	12·6	·4961	4535·1
3·5	·1378	349·95	8·1	·3189	1874·3	12·7	·5000	4607·7
3·6	·1417	370·24	8·2	·3228	1920·9	12·8	·5039	4680·6
3·7	·1457	391·09	8·3	·3268	1968·0	12·9	·5079	4754·0
3·8	·1496	412·52	8·4	·3307	2015·7	13·0	·5118	4828·0
3·9	·1535	434·51	8·5	·3346	2064·0	13·1	·5157	4902·6
4 0	·1575	457·08	8·6	·3386	2112·9	13·2	·5197	4977·7
4·1	·1614	480·22	8·7	·3425	2162·3	13·3	·5236	5053·4
4·2	·1654	503·93	8·8	·3465	2212·3	13·4	·5276	5129·7
4·3	·1693	528·21	8·9	·3504	2262·8	13·5	·5315	5206·5
4·4	·1732	553·07	9·0	·3543	2314·0	13·6	·5354	5283·9
4·5	·1772	578·49	9·1	·3583	2365·7	13·7	·5394	5361·9
4·6	·1811	604·49	9·2	·3623	2418·0	13·8	·5433	5440·5

TABLE No. 5.—WEIGHT OF COPPER WIRE IN LB. PER NAUTICAL MILE—*continued.*

Diameter		lb. per n. mile	Diameter		lb. per n. mile	Diameter		lb. per n. mile
mm.	inch		mm.	inch		mm.	inch	
13·9	0·5472	5519·6	17·7	0·6968	8950·1	21·4	0·8425	13083
14·0	·5512	5599·3	17·8	·7008	9051·5	21·5	·8465	13206
14·1	·5551	5679·6	17·9	·7047	9153·5	21·6	·8504	13329
14·2	·5591	5760·5	18·0	·7087	9256·1	21·7	·8543	13452
14·3	·5630	5841·9	18·1	·7126	9359·2	21·8	·8583	13577
14·4	·5669	5923·9	18·2	·7165	9462·9	21·9	·8622	13702
14·5	·5709	6006·4	18·3	·7205	9567·1	22·0	·8661	13827
14·6	·5748	6089·6	18·4	·7244	9672·0	22·1	·8701	13953
14·7	·5787	6173·3	18·5	·7283	9777·4	22 2	·8740	14080
14·8	·5827	6256·6	18·6	·7323	9883·4	22·3	·8780	14207
14·9	·5866	6342·4	18·7	·7362	9989·9	22·4	·8819	14334
15 0	·5906	6427·8	18·8	·7402	10097	22·5	·8858	14463
15·1	·5945	6513·7	18·9	·7441	10205	22·6	·8898	14592
15·2	·5984	6600·4	19·0	·7480	10313	22·7	·8937	14721
15·3	·6024	6687·5	19·1	·7520	10422	22·8	·8976	14851
15·4	·6063	6775·2	19·2	·7559	10531	22·9	·9016	14981
15·5	·6102	6863·5	19·3	·7598	10641	23·0	·9055	15113
15·6	·6142	6952·3	19·4	·7638	10752	23·1	·9094	15244
15·7	·6181	7041·7	19·5	·7677	10863	23·2	·9134	15377
15·8	·6220	7131·7	19·6	·7717	10975	23·3	.9173	15509
15·9	·6260	7222·3	19·7	·7756	11087	23·4	·9213	15643
16·0	·6299	7313·4	19·8	·7795	11200	23·5	·9252	15777
16·1	·6339	7405·1	19·9	·7835	11313	23·6	·9291	15911
16·2	·6378	7497·4	20·0	·7874	11427	23·7	·9331	16047
16·3	·6417	7590·2	20·1	·7913	11542	23·8	·9370	16182
16·4	·6457	7683·6	20·2	·7953	11657	23·9	·9409	16318
16·5	·6496	7777·6	20·3	·7992	11773	24·0	·9449	16455
16·6	·6535	7872·2	20·4	·8031	11889	24·1	·9488	16593
16·7	·6575	7967·3	20·5	·8071	12006	24·2	·9528	16731
16·8	·6614	8063·0	20·6	·8110	12123	24·3	9567	16869
16·9	·6654	8159·3	20·7	·8150	12241	24·4	·9606	17008
17·0	·6693	8256·2	20·8	·8189	12360	24·5	·9646	17148
17·1	·6732	8353·6	20·9	·8228	12479	24·6	·9685	17288
17·2	·6772	8451·6	21·0	·8268	12599	24·7	·9724	17429
17·3	·6811	8550·3	21·1	·8307	12719	24·8	·9764	17570
17·4	·6850	8649·2	21·2	·8346	12840	24·9	·9803	17712
17·5	·6890	8749·0	21·3	·8386	12961	25·0	·9843	17855
17·6	·6929	8849·2						

TABLE No. 6.—WEIGHT OF COPPER WIRE IN LB. PER NAUTICAL MILE.

Diameter		lb. per n. mile	Diameter		lb. per n. mile	Diameter		lb. per n. mile
inch	mm.		inch	mm.		inch	mm.	
0·001	0·0254	0·01843	0·047	1·1938	40·712	0·093	2·3622	159·40
·002	·0508	·07372	·048	1·2192	42·463	·094	2·3876	162·85
·003	·0762	·16587	·049	1·2446	44·250	·095	2·4130	166·33
·004	·1016	·29488	·050	1·2700	46·075	·096	2·4384	169·85
·005	·1270	·46075	·051	1·2954	47·936	·097	2·4637	173·41
·006	·1524	·66348	·052	1·3208	49·835	·098	2·4891	177·00
·007	·1778	·90307	·053	1·3462	51·770	·099	2·5145	180·63
·008	·2032	1·1795	·054	1·3716	53·742	·100	2·5399	184·30
·009	·2286	1 4928	·055	1·3970	55·751	·101	2·5653	188·00
·010	·2540	1·8430	·056	1·4224	57·796	·102	2·5907	191·75
·011	·2794	2·2300	·057	1·4478	59·879	·103	2·6161	195·52
·012	·3048	2·6539	·058	1·4732	61·998	·104	2·6415	199·34
·013	·3302	3·1147	·059	1·4986	64·155	·105	2·6669	203·19
·014	·3556	3·6123	·060	1·5240	66·348	·106	2·6923	207·18
·015	·3810	4·1467	·061	1·5494	68·578	·107	2·7177	211·00
·016	·4064	4·7181	·062	1·5748	70·845	·108	2·7431	214·97
·017	·4318	5·3263	·063	1·6002	73·149	·109	2·7685	218·97
·018	·4572	5·9713	·064	1·6256	75·489	·110	2·7939	223·00
·019	·4826	6·6532	·065	1·6519	77·867	·111	2·8193	227·08
·020	·5080	7·3720	·066	1·6764	80·281	·112	2·8447	231·19
·021	·5334	8·1276	·067	1·7018	82·732	·113	2·8701	235·33
·022	·5588	8·9201	·068	1·7272	85·220	·114	2·8955	239·52
·023	·5842	9·7495	·069	1·7526	87·745	·115	2·9209	243·74
·024	·6096	10·616	·070	1·7780	90·307	·116	2·9463	247·99
·025	·6350	11·519	·071	1·8034	92·906	·117	2·9717	252·29
·026	·6604	12·459	·072	1·8288	95·541	·118	2·9971	256·62
·027	·6858	13·435	·073	1·8542	98·213	·119	3·0225	260·99
·028	·7112	14·449	·074	1·8796	100·92	·120	3·0479	265·39
·029	·7366	15·500	·075	1·9050	103·67	·121	3·0733	269·83
·030	·7620	16·587	·076	1·9304	106·45	·122	3·0987	274·31
·031	·7874	17·711	·077	1·9558	109·27	·123	3·1241	278·83
·032	·8128	18·872	·078	1·9812	112·13	·124	3·1495	283·38
·033	·8382	20·070	·079	2·0060	115·02	·125	3·1749	287·97
·034	·8636	21·305	·080	2·0320	117·95	·126	3·2003	292·59
·035	·8890	22·577	·081	2·0574	120·92	·127	3·2257	297·26
·036	·9144	23·885	·082	2·0828	123·92	·128	3·2511	301·96
·037	·9398	25·231	·083	2·1082	126·96	·129	3·2765	306·69
·038	·9652	26·613	·084	2·1336	130·04	·130	3·3019	311·47
·039	·9906	28·032	·085	2·1590	133·16	·131	3·3273	316·28
·040	1·0160	29·488	·086	2·1844	136·31	·132	3·3527	321·12
·041	1·0414	30·981	·087	2·2098	139·50	·133	3·3781	326·01
·042	1·0668	32·510	·088	2·2352	142·72	·134	3·4035	330·93
·043	1·0922	34·077	·089	2·2606	145·98	·135	3·4289	335·89
·044	1·1176	35·680	·090	2·2860	149·28	·136	3·4543	340·88
·045	1·1430	37·321	·091	2·3114	152·62	·137	3·4797	345·91
·046	1·1684	38·998	·092	2·3368	155·99	·138	3·5051	350·98

TABLE No. 6.—WEIGHT OF COPPER WIRE IN LB. PER NAUTICAL MILE—*cont.*

Diameter		lb. per n. mile	Diameter		lb. per n. mile	Diameter		lb. per n. mile
inch	mm.		inch	mm.		inch	mm.	
0·139	3·5305	356·09	0·185	4·6989	630·77	0·231	5·8673	983·44
·140	3·5559	361·23	·186	4·7243	637·60	·232	5·8927	991·98
·141	3·5813	366·41	·187	4·7497	644·48	·233	5·9181	1000·5
·142	3·6067	371·62	·188	4·7751	651·39	·234	5·9435	1009·1
·143	3·6321	376·87	·189	4·8005	658·34	·235	5·9689	1017·8
·144	3·6575	382·16	·190	4·8259	665·32	·236	5·9943	1026·5
·145	3·6829	387·49	·191	4·8513	672·34	·237	6·0197	1035·2
·146	3·7083	392·85	·192	4·8767	679·40	·238	6·0451	1043·9
·147	3·7337	398·25	·193	4·9021	686·50	·239	6·0705	1052·7
·148	3·7591	403·69	·194	4·9275	693·63	·240	6·0959	1061·6
·149	3·7845	409·16	·195	4·9529	700·80	·241	6·1213	1070·4
·150	3·8099	414·67	·196	4·9783	708·01	·242	6·1467	1079·3
·151	3·8353	420·22	·197	5·0037	715·25	·243	6·1721	1088·3
·152	3·8607	425·81	·198	5·0291	722·53	·244	6·1975	1097·2
·153	3·8861	431·43	·199	5·0545	729·85	·245	6·2229	1106·3
·154	3·9115	437·09	·200	5·0799	737·20	·246	6·2483	1115·3
·155	3·9369	442·78	·201	5·1053	744·59	·247	6·2737	1124·4
·156	3·9623	448·51	·202	5·1307	752·02	·248	6·2991	1133·5
·157	3·9877	454·28	·203	5·1561	759·48	·249	6·3245	1142·7
·158	4·0131	460·09	·204	5·1815	766·98	·250	6·3499	1151·9
·159	4·0385	465·93	·205	5·2069	774·52	·251	6·3753	1161·1
·160	4·0639	471·81	·206	5·2323	782·09	·252	6·4007	1170·4
·161	4·0893	477·72	·207	5·2577	789·71	·253	6·4261	1179·7
·162	4·1147	483·68	·208	5·2831	797·35	·254	6·4515	1189·0
·163	4·1401	489·67	·209	5·3085	805·04	·255	6·4769	1198·4
·164	4·1655	495·69	·210	5·3339	812·76	·256	6·5023	1207·8
·165	4·1909	501·76	·211	5·3593	820·52	·257	6·5277	1217·3
·166	4·2163	507·86	·212	5·3847	828·32	·258	6·5531	1226·8
·167	4·2417	513·99	·213	5·4101	836·15	·259	6·5785	1236·3
·168	4·2671	520·17	·214	5·4355	844·02	·260	6·6039	1245·9
·169	4·2925	526·38	·215	5·4609	851·93	261	6·6293	1255·5
·170	4·3179	532·63	·216	5·4863	859·87	·262	6·6547	1265·1
·171	4·3433	538·91	·217	5·5117	867·85	·263	6·6801	1274·8
·172	4·3687	545·23	·218	5·5371	875·87	·264	6·7055	1284·5
·173	4·3941	551·59	·219	5·5625	883·92	·265	6·7309	1294·2
·174	4·4195	557·99	·220	5·5879	892·01	·266	6·7563	1304·0
·175	4·4449	564·42	·221	5·6133	900·14	·267	6·7817	1313·9
·176	4·4703	570·89	·222	5·6387	908·30	·268	6·8071	1323·7
·177	4·4957	577·39	·223	5·6641	916·50	·269	6·8325	1333·6
·178	4·5211	583·94	·224	5·6895	924·74	·270	6·8579	1343·5
·179	4·5465	590·52	·225	5·7149	933·02	·271	6·8833	1353·5
·180	4·5719	597·13	·226	5·7402	941·33	·272	6·9087	1363·5
·181	4·5973	603·78	·227	5·7657	949·68	·273	6·9341	1373·6
·182	4·6227	610·47	·228	5·7911	958·06	·274	6·9395	1383·7
·183	4·6481	617·20	·229	5·8165	966·49	·275	6·9849	1393·8
·184	4·6735	623·97	·230	5 8419	974·95	·276	7·0103	1403·9

TABLE No. 6.—WEIGHT OF COPPER WIRE IN LB. PER NAUTICAL MILE—*cont.*

Diameter		Lb. per n. mile	Diameter		Lb. per n. mile	Diameter		Lb. per n. mile
inch	mm.		inch	mm.		inch	mm.	
0·277	7·0357	1414·1	0·323	8·2040	1922·8	0·369	9·3724	2509·4
·278	7·0611	1424·3	·324	8·2294	1934·7	·370	9·3978	2525·1
·279	7·0865	1434·6	·325	8·2548	1946·7	·371	9·4232	2536·7
·280	7·1119	1444·9	·326	8·2802	1958·7	·372	9·4486	2550·4
·281	7·1373	1455·3	·327	8·3056	1970·7	·373	9·4740	2564·1
·282	7·1627	1465·6	·328	8·3310	1982·8	·374	9·4994	2577·9
·283	7·1881	1476·0	·329	8·3564	1994·9	·375	9 5248	2591·7
·284	7·2135	1486·5	·330	8·3818	2007·0	·376	9·5502	2605·6
·285	7·2389	1497·0	·331	8·4072	2019·2	·377	9·5756	2619·4
·286	7·2643	1507·5	·332	8·4326	2031·4	·378	9·6010	2633·4
·287	7·2897	1518·1	·333	8·4580	2043·7	·379	9·6264	2647·3
·288	7·3151	1528·7	·334	8·4834	2056·0	·380	9·6518	2661·3
·289	7·3405	1539·3	·335	8·5088	2068·3	·381	9·6772	2675·3
·290	7·3659	1550·0	·336	8·5342	2080·7	·382	9·7026	2689·4
·291	7·3913	1560·7	·337	8·5596	2093·1	·383	9·7280	2703·5
·292	7·4167	1571·4	·338	8·5850	2105·5	·384	9·7534	2717·6
·293	7·4421	1582·2	·339	8·6104	2118·0	·385	9·7788	2731·8
·294	7·4675	1593·0	·340	8·6358	2130·5	·386	9·8042	2746·0
·295	7·4929	1603·9	·341	8·6612	2143·1	·387	9·8296	2760·2
·296	7·5183	1614·8	·342	8·6866	2155·6	·388	9·8550	2774·5
·297	7·5437	1625·7	·343	8·7120	2168·3	·389	9·8804	2788·9
·298	7·5691	1636·7	·344	8·7374	2180·9	·390	9·9058	2803·2
·299	7·5945	1647·7	·345	8·7628	2193·6	·391	9·9312	2817·6
·300	7·6199	1658·7	·346	8·7882	2206·4	·392	9·9566	2832·0
·301	7·6453	1669·8	·347	8·8136	2219·1	·393	9·9820	2846·5
·302	7·6707	1680·9	·348	8·8390	2231·9	·394	10·007	2861·0
·303	7·6961	1692·0	·349	8·8644	2244·8	·395	10·033	2875·5
·304	7·7215	1703·2	·350	8·8898	2257·7	·396	10·058	2890·1
·305	7·7469	1714·5	·351	8·9152	2270·6	·397	10·084	2904·7
·306	7·7723	1725·7	·352	8·9406	2283·6	·398	10·109	2919·4
·307	7·7977	1737·0	·353	8·9660	2296·5	·399	10·134	2934·1
·308	7·8231	1748·3	·354	8·9914	2309·6	·400	10·160	2948·8
·309	7·8485	1759·7	·355	9·0168	2322·6	·401	10·185	2963·6
·310	7·8739	1771·1	·356	9·0422	2335·7	·402	10·211	2978·4
·311	7·8993	1782·6	·357	9·0676	2348·9	·403	10·236	2993·2
·312	7·9247	1794·0	·358	9·0930	2362·1	·404	10·261	3008·1
·313	7·9501	1805·6	·359	9·1184	2375·3	·405	10·287	3023·0
·314	7·9754	1817·1	·360	9·1438	2388·5	·406	10·312	3037·9
·315	8·0008	1828·7	·361	9·1692	2401·8	·407	10·338	3052·9
·316	8·0262	1840·3	·362	9·1946	2415·1	·408	10·363	3067·9
·317	8·0516	1852·0	·363	9·2200	2428·5	·409	10·388	3083·0
·318	8·0770	1863·7	·364	9·2454	2441·9	·410	10·414	3098·1
·319	8·1024	1875·5	·365	9·2708	2455·3	·411	10·439	3113·2
·320	8·1278	1887·2	·366	9·2962	2468·8	·412	10·465	3128·4
·321	8·1532	1899·0	·367	9·3216	2482·3	·413	10·490	3143·6
·322	8·1786	1910·9	·368	9·3470	2495·9	·414	10·515	3158·8

Table No. 6.—Weight of Copper Wire in Lb. per Nautical Mile—*continued.*

Diameter inch	Diameter mm.	Lb. per n. mile	Diameter inch	Diameter mm.	Lb. per n. mile	Diameter inch	Diameter mm.	Lb. per n. mile
0·415	10·541	3174·1	0·444	11·277	3633·2	0·473	12·013	4123·3
·416	10·566	3189·4	·445	11·303	3649·6	·474	12·039	4140·8
·417	10·592	3204·8	·446	11·328	3666·0	·475	12·065	4158·3
·418	10·617	3220·2	·447	11·354	3682·5	·476	12·090	4175·8
·419	10·642	3235·6	·448	11·379	3699·0	·477	12·116	4193·4
·420	10·668	3251·0	·449	11·404	3715·5	·478	12·141	4211·0
·421	10·693	3266·6	·450	11·430	3732·1	·479	12·166	4228·6
·422	10·719	3282·1	·451	11·455	3748·7	·480	12·192	4246·3
·423	10·744	3297·7	·452	11·481	3765·3	·481	12·217	4264·0
·424	10·769	3313·3	·453	11·506	3782·0	·482	12·243	4281·7
·425	10·795	3328·9	·454	11·531	3798·7	·483	12·268	4299·5
·426	10·820	3344·6	·455	11·557	3815·5	·484	12·293	4317·3
·427	10·846	3360·3	·456	11·582	3832·3	·485	12·319	4335·2
·428	10·871	3376·1	·457	11·608	3849·1	·486	12·344	4353·1
·429	10·896	3391·9	·458	11·633	3866·0	·487	12·370	4371·0
·430	10·922	3407·7	·459	11·658	3882·9	·488	12·395	4389·0
·431	10·947	3423·6	·460	11·684	3899·8	·489	12·420	4407·0
·432	10·973	3439·5	·461	11·709	3916·8	·490	12·446	4425·0
·433	10·998	3455·4	·462	11·735	3933·8	·491	12·471	4443·1
·434	11·023	3471·4	·463	11·760	3950·8	·492	12·497	4461·2
·435	11·049	3487·4	·464	11·785	3967·9	·493	12·522	4479·4
·436	11·074	3503·5	·465	11·811	3985·0	·494	12·547	4497·6
·437	11·100	3519·6	·466	11·836	4002·2	·495	12·573	4515·8
·438	11·125	8535·7	·467	11·862	4019·4	·496	12·598	4534·1
·439	11·150	3551·8	·468	11·887	4036·6	·497	12·624	4552·4
·440	11·176	3568·0	·469	11·912	4053·9	·498	12 649	4570·7
·441	11·201	3584·3	·470	11·938	4071·2	·499	12·674	4589·1
·442	11·227	3600·6	·471	11·963	4088·5	·500	12·700	4607·5
·443	11·252	3619·9	·472	11·989	4105·9			

Conversions for Tables 5 and 6.

The weights given in lb. per nautical mile when multiplied

by 0·8673 give lb. per statute mile.
by 0·4929 give lb. per 1000 yards.
by 0·5390 give lb. per kilometre.
by 0·2444 give kilogrammes per kilometre.

TABLE NO. 7.—BROWN AND SHARPE, OR AMERICAN GAUGE WIRES.

No.	Diameter in inches	Weight, lb. per s. mile	No.	Diameter in inches	Weight, lb. per s. mile	No.	Diameter in inches	Weight, lb. per s. mile
0000	0·460	3391·4	12	0·08081	104·6	27	0·0142	3·232
000	·40964	2689·0	13	·0720	83·09	28	·0126	2·544
00	·3648	2133·0	14	·06408	65·85	29	·0113	2·050
0	·32495	1692·0	15	·05706	52 26	30	·01003	1·612
1	·2893	1341·4	16	·05082	41·36	31	·00893	1·278
2	·25763	1063·6	17	·0453	32·89	32	·00795	1·013
3	·22942	843·4	18	·0403	26·03	33	·00708	0·8034
4	·20431	669·0	19	·0359	20·30	34	·00603	·5830
5	·18194	530·3	20	·0320	16·41	35	·00561	·5044
6	·16202	420·6	21	·0285	13·018	36	·00500	·4007
7	·14428	333·7	22	·0253	10·259	37	·00445	·3174
8	·1285	264·6	23	·0226	8·186	38	·00397	·2526
9	·11443	209·7	24	·0201	6·475	39	·00353	·1997
10	·1019	166·4	25	·0179	5·135	40	·00314	·1580
11	·09074	131·8	26	·0159	4·052			

TABLE NO. 8.—BROWN AND SHARPE, ROPE STRANDS.

Rope Strand	Construction	Diameter in inches	Weight, lb. per s. mile	Rope Strand	Construction	Diameter in inches	Weight, lb. per s. mile
427/16	$61 \times \frac{7}{16}$	1·372	18062	259/22	$37 \times \frac{7}{22}$	0·532	2717
427/17	$61 \times \frac{7}{17}$	1·222	14363	133/21	$19 \times \frac{7}{21}$	·427	1770
427/18	$61 \times \frac{7}{18}$	1·088	11367	133/22	$19 \times \frac{7}{22}$	·380	1395
427/19	$61 \times \frac{7}{19}$	0·969	8865	49/21	$7 \times \frac{7}{21}$	·256	657
427/20	$61 \times \frac{7}{20}$	·863	7167	49/22	$7 \times \frac{7}{22}$	·228	513
259/19	$37 \times \frac{7}{19}$	·754	5377	49/23	$7 \times \frac{7}{23}$	·203	410
427/22	$61 \times \frac{7}{22}$	·684	4480	49/24	$7 \times \frac{7}{24}$	·181	319
259/21	$37 \times \frac{7}{21}$	·598	3448				

TABLE No. 9.—WEIGHT OF COPPER WIRE. KILOG. PER KM.

Area in mm.²	0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
0	0	0·89	1·78	2·67	3·56	4·45	5·34	6·23	7·12	8·01
1	8·9	9·8	10·7	11·6	12·5	13·4	14·2	15·1	16·0	16·9
2	17·8	18·7	19·6	20·5	21·4	22·2	23·1	24·0	24·9	25·8
3	26·7	27·6	28·5	29·4	30·3	31·2	32·0	32·9	33·8	34·7
4	35·6	36·5	37·4	38·3	39·2	40·0	41·0	41·9	42·7	43·6
5	44·5	45·4	46·3	47·2	48·1	49·0	49·9	50·8	51·6	52·5
6	53·4	54·3	55·2	56·1	57·0	57·9	58·8	59·7	60·6	61·4
7	62·3	63·2	64·1	65·0	65·9	66·8	67·6	68·5	69·4	70·3
8	71·2	72·1	73·0	73·9	74·8	75·7	76·6	77·5	78·3	79·2
9	80·1	81 0	81·9	82·8	83·7	84·6	85·5	86·3	87·2	88·1
10	89·0	..	..	..	..	..	..	..	..	..

The above table can be used for any section of copper by shifting the decimal point.

TABLE No. 10.—CONTINENTAL NORMAL SECTIONS AND STRANDS.
Diameter of wire given in millimetres.

Area in mm.²	Strand	Strand if Test Wire is included	Area in mm.²	Strand	Strand if Test Wire is included
10	7×1·35	6×1·46	240	19×4·01	18×4·12
16	7×1·71	6×1·85	280	37×3·10	36×3·15
25	7×2·13	6×2·30	310	37×3·27	36×3·31
35	19×1·53	18×1·57	355	37×3·50	36×3·55
50	19×1·83	18×1·88	400	37×3·71	36×3·76
70	19×2·17	18×2·23	500	37×4·15	36×4·21
95	19×2·53	18×2·59	625	61×3·62	60×3·65
120	19×2·83	18×2·91	725	61×3·90	60×3·92
150	19×3·17	18×3·26	800	61×4·09	60×4·12
185	19×3·52	18×3·62	1000	91×3·74	90×3·76
210	19×3·75	18×3·86	..	..	..

TABLE No. 11.—BIRMINGHAM WIRE GAUGE.

(Resistance given is that of plain annealed copper.)

No.	Diameter		Area			Lb. per yard	Lb. per s. mile	Ohms per yard	Yards per ohm	Ohms per lb.	Lb. per ohm
	inch	mm.	Circular mils	sq. inch	mm.^{2}						
4/0	0·454	11·530	206120	0·1619	104·4	1·872	3295	0·0001485	6734	0·00007933	12610
3/0	·425	10·800	180630	·1419	91·54	1·641	2888	·0001694	5903	·0001032	9690
2/0	·380	9·652	144400	·1134	73·15	1·311	2308	·0002120	4717	·0001617	6184
0	·340	8·636	115600	·09079	58·57	1·050	1848	·0002648	3776	·0002522	3965
1	·300	7·620	90000	·07069	45·60	0·8176	1439	·0003401	2940	·0004160	2404
2	·284	7·214	80660	·06335	40·87	·7324	1289	·0003795	2635	·0005182	1930
3	·259	6·579	67080	·05269	33·99	·6091	1072	·0004563	2192	·0007491	1335
4	·238	6·045	56640	·04449	28·70	·5144	905·4	·0005403	1851	·001050	952·4
5	·220	5·588	48400	·03801	24·52	·4395	773·5	·0006325	1581	·001439	694·9
6	·203	5·156	41210	·03237	20·88	·3743	658 7	·0007427	1346	·001987	504·0
7	·180	4·572	32400	·02545	16·42	·2943	517·9	·0009446	1059	·003210	311·5
8	·165	4·191	27230	·02138	13·79	·2472	435·1	·001124	889·7	·004547	219·9
9	·148	3·759	21900	·01720	11·10	·1989	350·0	·001398	715·3	·007029	142·3
10	·134	3·404	17960	·01410	9·096	·1630	286·9	·001705	586·5	·01046	95·60
11	·120	3·048	14400	·01131	7·296	·1308	230·2	·002126	470·4	·01625	61·54
12	·109	2·769	11880	·009331	6·019	·1079	189·9	·002576	388·2	·02387	41·89
13	·095	2·413	9025	·007088	4·572	·08193	144·2	·003392	294·8	·04140	24·15
14	·083	2·108	6889	·005411	3·491	·06256	110·1	·004443	225·1	·07102	14·08
15	·072	1·829	5184	·004072	2·627	·04709	82·87	·005904	169·4	·1254	7·974
16	·065	1·651	4225	·003318	2·140	·03836	67·52	·007245	138·0	·1889	5·294
17	·058	1·473	3364	·002642	1·704	·03055	53·76	·009099	109·9	·2978	3·358
18	·049	1·245	2401	·001886	1·217	·01897	33·38	·01275	78·43	·6721	1·488
19	·042	1·067	1764	·001385	0·8935	·01601	28·18	·01736	57·60	1·084	0·9225
20	·035	0·889	1225	·0009621	·6207	·01113	19·58	·02499	40·02	2·245	·4454
21	·032	·8128	1024	·0008042	·5188	·009301	16·37	·02989	33·46	3·214	·3111

TABLE NO. 11.—BIRMINGHAM WIRE GAUGE—*continued.*

(Resistance given is that of plain annealed copper.)

No.	Diameter		Area			Lb. per yard	Lb. per s. mile	Ohms per yard	Yards per ohm	Ohms per lb.	Lb. per ohm
	inch	mm.	Circular mils	sq. inch	mm.²						
22	0·028	0·7112	784	0·0006158	0·3973	0·007119	12·53	0·03904	25·61	5·484	0·1823
23	·025	·6350	625	·0004909	·3167	·005676	9·990	·04897	20·42	8·628	·1159
24	·022	·5588	484	·0003801	·2452	·004395	7·735	·06325	15·81	14·39	·06949
25	·020	·5080	400	·0003142	·2027	·003633	6·394	·07651	13·07	21·06	·04748
26	·018	·4572	324	·0002545	·1642	·002943	5·179	·09446	10·59	32·10	·03115
27	·016	·4064	256	·0002011	·1297	·002325	4·092	·1195	8·368	51·40	·01946
28	·014	·3556	196	·0001539	·09928	·001780	3·132	·1562	6·402	87·75	·01140
29	·013	·3302	169	·0001327	·08560	·001535	2·700	·1812	5·519	118·1	·008467
30	·012	·3048	144	·0001131	·07296	·001308	2·302	·2126	4·704	162·5	·006151
31	·010	·2540	100	·00007854	·05067	·0009084	1·598	·3061	3·267	337·0	·002967
32	·009	·2286	81	·00006362	·04105	·0007359	1·295	·3778	2·618	513·4	·001948
33	·008	·2032	64	·00005027	·03243	·0005814	1·023	·4782	2·092	822·5	·001216
34	·007	·1778	49	·00003849	·02483	·0004451	0·7831	·6216	1·602	1403·3	·0007127
35	·005	·1270	25	·00001964	·01267	·0002271	0·3996	1·2245	0·817	5392·0	·0001855
36	·004	·1016	16	·00001257	·008110	·0001454	0·2557	1·9130	0·523	13158·0	·0000760

TABLE No. 12.—MAINS.

Nominal Area	Copper Strand	Diameter of each Wire		Diameter of Strand		Calculated Area	Effective Area	Resistance in Ohms per Mile at 60° F.				Weight, lb. per Mile	Weight, lb. per 1000 Yards	Weight, lb. per 1000 Yards
square inch	inch	inch	mm.	inch	mm.	square inch	square inch	100 % Plain Copper	98 % Plain Copper	100% Tinned Copper	98 % Tinned Copper	Standard	Standard	Minimum
0·025	7/·068	·068	1·727	0·204	5·181	0·0254218	·0249919	1·69323	1·72779	1·71016	1·74437	526	299	293
·040	7/·084	·084	2·134	·252	6·401	·0387924	·0381364	1·10962	1·13227	1·12072	1·14313	803	456	447
·050	7/·095	·095	2·413	·285	7·240	·0496176	·0487786	0·867536	0·885241	0·876212	0·893736	1027	584	572
·050	19/·058	·058	1·473	·290	7·366	·0501995	·0496235	·858997	·876528	·867587	·884939	1041	591	580
·075	19/·072	·072	1·829	·360	9·145	·0773587	·0759163	·557420	·568795	·562993	·574253	1604	911	893
·100	19/·082	·082	2·083	·410	10·416	·100339	·0984681	·429755	·438526	·434053	·442734	2080	1182	1158
·125	19/·092	·092	2·337	·460	11·687	·126305	·123950	·341405	·348373	·344820	·351716	2619	1488	1458
·15	19/·101	·101	2·565	·505	12·827	·152225	·149386	·283273	·289054	·286105	·291828	3156	1793	1757
·15	37/·072	·072	1·829	·504	12·805	·150646	·147764	·286382	·292227	·289246	·295031	3125	1776	1740
·20	37/·082	·082	2·083	·574	14·583	·195398	·191660	·220792	·225298	·223000	·227460	4054	2303	2257
·25	37/·092	·092	2·337	·644	16·360	·245962	·241257	·175402	·178982	·177156	·180700	5103	2900	2842
·30	37/·101	·101	2·565	·707	17·957	·296439	·290769	·145535	·148505	·146991	·149931	6150	3494	3424
·35	37/·110	·110	2·794	·770	19·560	·351624	·344898	·122694	·125198	·123921	·126400	7295	4145	4062
·40	37/·118	·118	2·997	·826	20·980	·404628	·396888	·106622	·108798	·107688	·109842	8395	4770	4674
·40	61/·092	·092	2·337	·828	21·034	·405505	·397671	·106412	·108584	·107452	·109601	8414	4781	4685
·45	61/·098	·098	2·489	·882	22·402	·460122	·451233	·0937813	·0956952	·0947191	·0966135	9548	5425	5317
·50	61/·101	·101	2·565	·909	23·087	·488724	·479282	·0882929	·0900948	·0891758	·0909593	10140	5762	5647
·55	61/·108	·108	2·743	·972	24·688	·558815	·548019	·0772185	·0787944	·0779907	·0795502	11600	6588	6456
·60	61/·110	·110	2·794	·990	25·148	·584704	·573408	·0737994	·0753056	·0745374	·0760282	12030	6836	6699
·65	61/·118	·118	2·997	1·062	26·974	·667089	·654201	·0646853	·0660054	·0653321	·0666388	13840	7865	7708
·70	91/·098	·098	2·489	1·078	27·380	·686411	·673084	·0628706	·0641537	·0634993	·0647693	14240	8094	7932
·75	91/·101	·101	2·565	1·111	28·217	·729080	·714924	·0591911	·0603991	·0597831	·0609787	15130	8597	8425
·80	91/·104	·104	2·642	1·144	29·064	·773034	·758025	·0558256	·0569649	·0563839	·0575115	16040	9115	8933
·90	91/·110	·110	2·794	1·210	30·737	·864804	·848013	·0499016	·0509200	·0504006	·0514086	17950	10200	9993
1·00	91/·118	·118	2·997	1·298	32·969	·995167	·975845	·0433646	·0442496	·0437983	·0446743	20650	11730	11500
1·00	127/·101	·101	2·565	1·313	33·345	1·017506	·997652	·0424168	·0432824	·0428410	·0436978	21120	12000	11760

TABLE No. 13.—LEGAL

No.	Diameter		Area			Amps. at 1000 per sq. in.	Amp., I.E.E. rule	Resistance per	
								Plain Copper	
	inch	mm.	circular mils	square inch	square millimetre			100 %	98 %
7/0	0·500	12·700	250000	0·196350	126·68	196	197	0·216016	0·220424
6/0	·464	11·785	215300	·169093	109·09	169	174·6	0·250836	0·255955
5/0	·432	10·973	186600	·146574	94·562	146·6	155·3	0·289374	0·295280
4/0	·400	10·160	160000	·125664	81·072	125·7	136·9	0·337525	0·344413
3/0	·372	9·4487	138400	·108687	70·119	108·7	121·5	0·390247	0·398220
2/0	·348	8·8391	121100	·095115	61·363	95·11	108·9	0·444906	0·453985
0	·324	8·2295	105000	·082448	53·191	82·45	96·90	0·513259	0·523733
1	·300	7·6200	90000	·070686	45·603	70·69	85·41	0·598664	0·610882
2	·276	7·0103	76180	·059828	38·598	59·83	74·49	0·707307	0·721742
3	·252	6·4008	63500	·049876	32·178	49·88	64·17	0·848448	0·865763
4	·232	5·8927	53820	·042273	27·273	42·27	56·02	1·00103	1·02145
5	·212	5·3847	44940	·035299	22·773	35·30	48·33	1·19882	1·22329
6	·192	4·8768	36860	·028953	18·679	28·95	41·07	1·46159	1·49141
7	·176	4·4703	30980	·024329	15·695	24·33	35·61	1·74342	1·77891
8	·160	4·0640	25600	·020106	12·972	20·11	30·46	2·10468	2·14763
9	·144	3·6576	20740	·016286	10·507	16·29	25·63	2·59838	2·65141
10	·128	3·3512	16380	·012868	8·3018	12·87	21·13	3·28783	3·35493
11	·116	2·9463	13460	·010568	6·8182	10·57	17·98	4·00416	4·08588
12	·104	2·6416	10820	·008495	5·4804	8·495	15·03	4·98149	5·08316
13	·092	2·3368	8464	·006648	4·2887	6·648	12·29	6·36577	6·49568
14	·080	2·0320	6400	·005026	3·2429	5·027	9·775	8·41872	8·59093
15	·072	1·8288	5184	·004071	2·6267	4·072	8·223	10·3935	10·6056
16	·064	1·6256	4096	·003217	2·0755	3·217	6·779	13·1542	13·4227
17	·056	1·4224	3136	·002463	1·5890	2·463	5·445	17·1811	17·5317
18	·048	1·2192	2304	·0018095	1·1675	1·810	4·230	23·3853	23·8626
19	·040	1·0160	1600	·0012567	0·81072	1·257	3·137	33·7525	34·4413
20	·036	0·91439	1296	·0010179	0·65668	1·018	2·638	41·5742	42·4227
21	·032	0·81280	1024	·0008042	0·51886	0·8042	2·142	52·6169	53·6908

The Inst. E.E. rule for the carrying capacity of a conductor is:—

STANDARD WIRE GAUGE.

mile at 60° F.		Lb. per yard	Yards per lb.	Lb. per km.	Lb. per mile	Minimum lb. per mile	Ohms per lb.	Lb. per ohm
Tinned Copper								
100 %	98 %							
0·218176	0·222539	2·270	0·4405	2482	3995	3915	0·00005397	18530
0·253345	0·258412	1·955	0·5115	2138	3441	3372	0·00007274	13750
0·292268	0·298113	1·695	0·5900	1854	2983	2923	0·00009678	10330
0·340900	0·347718	1·453	0·6882	1590	2558	2507	0·0001316	7599
0 394149	0·402032	1·257	0·7955	1375	2212	2168	0·0001760	5682
0·449355	0·458342	1 099	0·9099	1202	1935	1896	0·0002300	4348
0·518391	0·528759	0·9534	1·049	1043	1678	1644	0·0003059	3269
0·604651	0·616744	0·8176	1·223	894·2	1439	1410	0·0004166	2403
0·714380	0·728668	0·6921	1·445	756·9	1218	1194	0·0005807	1722
0·856933	0·874071	0·5767	1·734	630·7	1015	994·7	0·0008359	1196
1·01105	1·03127	0·4888	2·046	534·5	860 2	843·0	0·001164	859·1
1·21081	1·23502	0·4082	2·450	446·4	718·4	704·0	0·001669	599·2
1·47620	1·50573	0·3374	2·988	366·1	589·1	577·3	0·002482	402·9
1·76085	1·79607	0·2813	3·555	307·7	495·1	485·2	0·003512	284·7
2·12573	2·16824	0·2325	4·301	254·3	409·2	401·0	0·005142	194·5
2·62436	2·67685	0·1884	5·308	206·0	331·5	324·9	0·007837	127·6
3·32071	3·38712	0·1488	6·720	162·7	261·9	256·7	0·01225	79·68
4·04420	4·12509	0·1222	8·183	133·7	215·1	210·8	0·01861	53·73
5·03131	5·13193	0·09824	10·18	107·4	172·9	169·4	0·02881	34 71
6·42950	6·43832	0·07688	13·01	84·08	135·3	132·6	0·04705	21·25
8·50330	8·67336	0·05813	17·20	63·57	102·3	100·3	0·08230	12·15
10·4974	10·7073	0·04709	21·24	51·50	82·87	81·21	0·1254	7·974
13·2858	13·5515	0·03720	26·88	40·68	65·47	64·16	0·2010	4·975
17·3529	17·6999	0·02848	35·11	31·14	50·12	49·12	0·3428	2·917
23·6192	24·0916	0·02093	47·78	22·89	36·83	36·09	0·6348	1·575
34·0900	34·7718	0·01453	68·82	15·90	25·58	25·07	1·316	0·7599
41·9900	42·8298	0·01177	84·96	12·88	20·72	20·31	2·006	0·4985
53·1431	54·2060	0·009301	107·5	10·17	16·37	16·04	3·214	0·3111

Current in amperes = 2·6 (area in thousandths of a square inch) $^{0·82}$.

TABLE No. 13.—LEGAL

No.	Diameter inch	Diameter mm.	Area Circular mils	Area square inch	Area square millimetre	Amps. at 1000 per sq. in.	Amp., I.E.E. rule	Resistance per Plain Copper 100 %	Resistance per Plain Copper 98 %
22	0·028	0·71119	784	0·00061575	0·39725	0·6158	1·747	68·7247	70·1272
23	·024	·60960	576	·00045239	·29186	·4524	..	93·5414	95·4504
24	·022	·55880	484	·00038013	·24524	·3801	..	111·322	113·594
25	·020	·50800	400	·00031416	·20268	·3142	..	134·699	137·448
26	·018	·45720	324	·00025446	·16417	·2545	..	166·296	169·690
27	·0164	·41656	269	·00021124	·13628	·2112	..	200·326	204·415
28	·0148	·37592	219	·00017203	·11099	·1720	..	245·982	251·002
29	·0136	·34544	185	·00014527	·093719	·1453	..	291·978	297·937
30	·0124	·31496	153·8	·00012076	·079100	·1208	..	350·415	357·567
31	·0116	·29464	134·6	·00010569	·068181	·1057	..	400·416	408·583
32	·0108	·27432	116·6	·000091609	·059102	·0916	..	461·933	471·360
33	·0100	·25398	100·0	·000078540	·050670	·0785	..	538·798	549·794
34	·0092	·23398	84·64	·000066476	·042887	·0665	..	636·577	649·568
35	·0084	·21336	70·56	·000055417	·035752	·0554	..	763·603	779·187
36	·0076	·19304	57·76	·000045365	·029267	·0454	..	932·822	951·859
37	·0068	·17272	46·24	·000036317	·023430	·0363	..	1165·22	1189·00
38	·0060	·15240	36·00	·000028274	·018241	·0283	..	1496·66	1527·20
39	·0052	·13508	27·04	·000021237	·013701	·0212	..	1992·60	2033·26
40	·0048	·12192	23·04	·000018095	·011674	·0181	..	2338·53	2386·26
41	·0044	·11176	19·36	·000015205	·0098097	·0152	..	2783·05	2839·85
42	·0040	·10160	16·00	·000012566	·0081072	·0126	..	3367·5	3436·2
43	·0036	·09144	12·96	·000010179	·0065668	·0102	..	4157·4	4242·3
44	·0032	·08128	10·24	·0000080425	·0051886	·0080	..	5261·7	5369·1
45	·0028	·07119	7·840	·0000061575	·0039725	·0062	..	6872·4	7012·7
46	·0024	·06096	5·760	·0000045239	·0029186	·0045	..	9354·1	9545
47	·0020	·05080	4·000	·0000031416	·0020268	·0031	..	13470	13745
48	·0016	·04064	2·560	·0000020106	·0012972	·0020	..	21047	21476
49	·0012	·03048	1·440	·0000011310	·00072965	·0011	..	37417	38180
50	·0010	·02540	1·000	·0000007854	·00050670	·0008	..	53880	54979

The Inst.E.E. rule for the carrying capacity of a conductor is :—

STANDARD WIRE GAUGE—*continued.*

mile at 60° F. Tinned Copper 100 %	98 %	Lb. per yard	Yards per lb.	Lb. per km.	Lb. per mile	Minimum lb. per mile	Ohms per lb.	Lb. per ohm
69·4119	70·8001	0·007120	140·4	7·786	12·53	12·28	5·484	0·1823
94·6946	96·3664	·005231	191·2	5·721	9·206	9·022	10·16	·09843
112·435	114·684	·004395	227·5	4·807	7·735	7·850	14·39	·06949
136·046	138·767	·003633	275·3	3·973	6·394	6·266	21·07	·04746
167·959	171·318	·002943	339·8	3·218	5·179	5·075	32·11	·03114
202·330	206·091	·002442	409·5	2·671	4·298	4·212	46·63	·02145
248·441	253·410	·001989	502·8	2·175	3·500	3·430	70·29	·01423
294·898	300·796	·001680	505·2	1·837	2·957	2·898	98·51	·01015
353·919	360·998	·001397	715·8	1·527	2·458	2·409	142·5	·007018
404·420	412·509	·001222	818·3	1·337	2·151	2·108	186·1	·005373
466·552	475·883	·001059	944·3	1·158	1·864	1·827	247·9	·004034
544·186	555·070	·0009080	1101	0·9930	1·598	1·566	337·2	·002966
642·943	655·801	·0007688	1301	0·8408	1·353	1·326	470·5	·002125
771·239	786·664	·0006409	1560	0·7009	1·128	1·105	677·0	·001477
942·150	960·994	·0005245	1907	0·5736	0·9231	0·9046	1011	·0009891
1176·87	1200·41	·0004200	2381	0·4593	0·7391	0·7243	1576	·0006345
1511·62	1541·86	·0003269	3059	0·3575	0·5753	0·5638	2602	·0003843
2012·52	2052·77	·0002456	4072	0·2686	0·4322	0·4236	4609	·0002170
2361·92	2409·16	·0002093	4778	0·2289	0·3683	0·3609	6348	·0001575
2810·9	2867·1	·0001759	5685	0·1923	0·3095	0·3003	8989	·0001112
3401·2	3469·2	·0001453	6882	0·1590	0·2558	0·2507	13160	·00007599
4199·0	4282·9	·0001177	8496	0·1288	0·2072	0·2031	20060	·00004985
5314·3	5420·6	·00009301	10750	0·1017	0·1637	0·1604	32140	·00003111
6941·2	7080·0	·00007120	14040	0·07786	0·1253	0·1228	54840	·00001823
9447·7	9636·6	·00005231	19120	0·05721	0·09206	0·09022	101620	·000009841
13605	13877	·00003632	27530	0·03972	0·06392	0·06264	210730	·000004745
21257	21682	·00002325	43010	0·02543	0·04092	0·04010	514170	·000001945
37791	38547	·00001308	76450	0·01430	0·02302	0·02256	1625540	·0000006152
54419	55507	·00000908	110100	0·009930	0·01598	0·01566	3371710	·0000002966

Current in amperes = 2·6 (area in thousandths of a square inch) $^{0\cdot82}$.

TABLE No. 14.—

Wire or Strand L.W.G.	Diam. of Wire inch	Diam. of Wire mm.	Diam. of Strand inch	Diam. of Strand mm.	Amperes at 1000 per sq. in.	Amperes I.E.E. rule	Calculated Area sq. in.	Effective Area sq. in.
1/22	0·028	0·7112	0·028	0·7112	0·6158	1·747	0·00061575	0·00061575
1/21	·032	·8128	·032	·8128	·8042	2·142	·0008042	·0008042
3/25	·020	·5080	·043	1·092	·9240	2·452	·00094248	·00092399
1/20	·036	·9144	·036	0·9144	1·018	2·638	·0010179	·0010179
3/24	·022	·5588	·047	1·194	1·115	2·868	·0011404	·00111546
1/19	·040	1·016	·040	1·016	1·257	3·137	·0012567	·0012567
3/23	·024	0·6096	·052	1·321	1·330	3·307	·00135717	·00133056
1/18	·048	1·219	·048	1·219	1·810	4·230	·0018095	·0018095
3/22	·028	0·7112	·060	1·524	1·811	4·258	·00184725	·00181103
7/25	·020	·5080	·060	1·524	2·162	4·921	·00219912	·00216193
3/21	·032	·8128	·069	1·753	2·365	5·301	·00241265	·00236534
1/17	·056	1·422	·056	1·422	2·463	5·445	·002463	·002463
7/24	·022	0·5588	·066	1·676	2·610	5·751	·00266093	·0026099
3/20	·036	·9144	·078	1·981	2·994	6·444	·00305361	·00299373
7/23	·024	·6096	·072	1·829	3·113	6·636	·00316673	·00311318
1/16	·064	1·625	·064	1·625	3·217	6·779	·003217	·003217
3/19	·040	1·016	·086	2·184	3·696	7·644	·00376992	·00369599
1/15	·072	1·829	·072	1·829	4·072	8·223	·00407151	·00407151
7/22	·028	0·7112	·084	2·134	4·266	8·543	·00431025	·00423736
7/21½	·030	·7620	·090	2·286	4·896	9·565	·00494802	·00486435
1/14	·080	2·032	·080	2·032	5·027	9·775	·00502656	·00502656
3/18	·048	1·219	·103	2·616	5·361	10·31	·00542868	·00532223
7/21	·032	0·8128	·096	2·483	5·571	10·63	·00562975	·00553455
7/20½	·033	·8380	·099	2·515	5·925	11·19	·00598710	·00588586
1/13	·092	2·337	·092	2·337	6·648	12·29	·00664762	·00664762
7/20	·036	0·9144	·108	2·743	7·052	12·90	·00712509	·00700461
1/12	·104	2·642	·104	2·642	8·495	15·03	·00849488	·00849488
7/19	·040	1·016	·120	3·048	8·708	15·34	·00879648	·00864774
1/11	·116	2·946	·116	2·946	10·57	17·98	·0105683	·0105683
19/22	·028	0·7112	·140	3·556	11·57	19·36	·0116992	·0114546
7/18	·048	1·219	·144	3·658	12·54	20·68	·0126699	·0124556
1/10	·128	3·251	·128	3·251	12·87	21·13	·0128679	·0128679
19/21	·032	0·8128	·160	4·064	15·10	24·09	·0152813	·0149963
1/9	·144	3·658	·144	3·658	16·29	25·63	·0162860	·0162860
7/17	·056	1·422	·168	4·267	17·06	26·62	·0172411	·0169495
19/20	·036	0·9144	·180	4·572	19·12	29·23	·0193395	·0189789
1/8	·160	4·064	·160	4·064	20·11	30·46	·0201062	·0201062

STANDARD WIRES AND STRANDS.

Resistance in Ohms per mile at 60° F.				Standard Weight			Minimum Weight lb. per mile
100 per cent. Plain Copper	98 per cent. Plain Copper	100 per cent. Tinn'd Copper	98 per cent. Tinn'd Copper	lb. per mile	lb. per km.	lb. per 1000 yd.	
68·7247	70·1272	69·4119	70·8001	12·53	7·786	7·12	12·28
52·6169	53·6908	53·1431	54·2060	16·37	10·17	9·30	16·04
45·7979	46·7325	46·2558	47·1809	19·42	12·07	11·04	19·03
41·5742	42·4227	41·9900	42·8298	20·72	12·88	11·77	20·31
37·9367	38·7109	38·3161	39·0824	23·49	14·60	13·35	23·02
33·7525	34·4413	34·0900	34·7718	25·58	15·90	14·53	25·07
31·8041	32·4531	32·1221	32·7645	27·96	17·37	15·89	27·40
23·3853	23·8626	23·6192	24·0916	36·83	22·89	20·93	36·09
23·3664	23·8432	23·6000	24·0720	38·05	23·64	21·62	37·29
19·5737	19·9732	19·7695	20·1649	45·23	28·11	25·70	44·33
17·8905	18·2556	18·0694	18·4308	49·71	30·89	28·24	48·72
17·1811	17·5317	17·3529	17 6999	50·12	31·14	28·48	49·12
16·2139	16·5449	16·3761	16·7036	54·71	34·00	31·08	53·62
14·1352	14·4237	14·2766	14·5621	62·92	39·10	35 75	61·67
13·5929	13·8703	13·7288	14·0034	65·12	40·47	37·00	63·83
13·1542	13·4227	13·2858	13·5515	65·47	40·68	37·20	64·16
11·4494	11·6831	11·5639	11·7952	77·68	48·27	44·14	76·14
10·3935	10·6056	10·4974	10·7073	82·87	51·50	47·09	81·21
9·98668	10·1905	10·0865	10·2882	88·63	55·07	50·36	86·87
8·69943	8·87697	8·78643	8·96216	101·8	61·40	57·84	99·76
8·41872	8·59053	8·50330	8·67336	102·3	63·57	58·13	100·3
7·95102	8·11328	8·03053	8·19114	111·8	69·47	63·52	109·6
7·64600	7·80204	7·72246	7·87691	115·8	71·95	65·79	113·5
7·18963	7·33636	7·26153	7·40676	123·2	76·55	70·00	120·7
6·36577	6·49568	6·42950	6·43832	135·3	84·08	76·88	132·6
6·04133	6·16463	6·10175	6·22378	146·6	91·10	83·30	143·7
4·98149	5·08316	5·03131	5·13193	172·9	107·4	98·24	169·4
4·89344	4·99331	4·94238	5·04122	180·9	112·4	102·8	177·3
4·00416	4·08588	4·04420	4·12509	215·1	133·7	122·2	210·8
3·69432	3·76972	3·73127	3·80589	240·8	149·6	136·8	236·0
3·39742	3·46676	3·43140	3·50003	260·5	161·9	148·0	255·3
3·28783	3·35493	3·32071	3·38712	261·9	162·7	148·8	256·7
2·82183	2·87942	2·85005	2·90705	314·6	195·5	178·7	308·3
2·59838	2·65141	2·62436	2·67685	331·5	206·0	188·4	324·9
2·49665	2·54760	2·52162	2·57205	354·5	220·3	201·4	347·4
2·22969	2·27520	2·25199	2·29703	398·3	247·5	226·3	390·3
2·10468	2·14763	2·12573	2·16824	409·2	254·3	232·5	401·0

TABLE No. 14.—

Wire or Strand L.W.G.	Diam. of Wire inch	Diam. of Wire mm.	Diam. of Strand inch	Diam. of Strand mm.	Amperes at 1000 per sq. in.	Amperes I.E.E. rule	Calculated Area sq. in.	Effective Area sq. in.
7/16	0·064	1·626	0·192	4·877	22·27	33·12	0·0225189	0·0221381
19/19	·040	1·016	·200	5·080	23·60	34·74	·0238762	·0234310
1/7	·176	4·470	·176	4·470	24·33	35·61	·0243285	·0243285
7/15	·072	1·829	·216	5·486	28·22	40·22	·0285006	·0280187
1/6	·192	4·877	·192	4·877	28·95	41·07	·0289529	·0289529
19/18	·048	1·219	·240	6·096	33·99	46·85	·0343816	·0337405
7/14	·080	2·032	·240	6·096	34·83	47·80	·0351859	·0345909
1/5	·212	5·385	·212	5·385	35·30	48·33	·0352990	·0352990
37/20	·036	0·9144	·252	6·401	37·22	50·47	·0376612	·0369408
1/4	·232	5·893	·232	5·893	42·27	56·02	·0422733	·0422733
37/19	·040	1·016	·280	7·112	45·96	61·07	·0464957	·0456064
7/13	·092	2·337	·276	7·010	46·05	60·10	·0465333	·0457465
19/17	·056	1·422	·280	7·112	46·27	60·33	·0467972	·0459247
1/3	·252	6·401	·252	6·401	49·88	64·17	·0498760	·0498760
7/12	·104	2·642	·312	7·925	58·84	73·47	·0594642	·0584587
1/2	·276	7·010	·276	7·010	59·83	74·49	·0598286	·0598286
19/16	·064	1·626	·320	8·128	60·39	75·06	·0611228	·0599831
37/18	·048	1·219	·336	8·534	66·19	80·91	·0669537	·0656730
1/1	·300	7·620	·300	7·620	70·69	85·41	·0706860	·0706860
7/11	·116	2·946	·348	8·839	73·22	87·90	·0739781	·0727272
19/15	·072	1·829	·360	9·144	76·50	91·12	·0773587	·0759163
1/0	·324	8·230	·324	8·230	82·45	96·90	·0824481	·0824481
7/10	·128	3·251	·384	9·754	89·17	103·3	·0900754	·0885523
37/17	·056	1·422	·392	9·957	90·06	104·2	·0911314	·0893883
19/14	·080	2·032	·400	10·16	94·42	108·3	·0955046	·0937239
1/00	·348	8·839	·348	8·839	95·11	108·9	·0951150	·0951150
1/000	·372	9·449	·372	9·449	108·7	121·5	·108687	·108687
61/18	·048	1·219	·432	10·97	109·1	121·9	·110383	·108250
7/9	·144	3·658	·432	10·97	112·9	125·4	·114002	·112074
37/16	·064	1·626	·448	11·38	117·6	129·6	·119029	·116752
19/13	·092	2·337	·460	11·68	124·9	136·2	·126305	·123950
1/0000	·400	10·16	·400	10·16	125·7	136·9	·125664	·125664
7/8	·160	4·064	·480	12·19	139·3	149·0	·140743	·138363
1/00000	·432	10·97	·432	10·97	146·6	155·3	·146574	·146574
61/17	·056	1·422	·504	12·80	148·5	157·0	·150244	·147341
37/15	·072	1·829	·504	12·80	148·9	157·3	·150646	·147764
19/12	·104	2·642	·520	13·21	159·5	166·4	·161403	·158393

Standard Wires and Strands—*continued.*

Resistance in Ohms per mile at 60° F.				Standard Weight			Minimum Weight
100 per cent. Plain Copper	98 per cent. Plain Copper	100 per cent. Tinn'd Copper	98 per cent. Tinn'd Copper	lb. per mile	lb. per km.	lb. per 1000 yd.	lb. per mile
1·91150	1·95052	1·93062	1·96923	463·1	287·8	263·1	453·9
1·80603	1·84289	1·82409	1·86057	491·7	305·5	279·4	481·9
1·74342	1·77891	1·76085	1·79607	495·1	307·7	281·3	485·2
1·51032	1·54114	1·52542	1·55593	586·2	364·3	333·1	574·5
1·46159	1·49141	1·47620	1·50573	589·1	366·1	337·4	577·3
1·25419	1·27976	1·26673	1·29207	707·9	439·9	402·2	693·7
1·22336	1·24832	1·23559	1·26031	723·6	449·6	411·1	709·1
1·19882	1·22329	1·21081	1 23502	718·4	446·4	408·2	704·0
1·14554	1·16891	1·15699	1·18285	775·8	482·1	440·8	760·3
1·00103	1·02146	1·01105	1·03127	860·2	534·5	488·8	843·0
0·927879	0·946815	0·937158	0·955901	957·9	595·2	544·3	938·7
·925038	·943916	·934288	·952974	957·1	594·7	543·8	938·0
·921447	·940252	·930661	·949275	963·3	598·6	547·3	944·0
·848448	·865763	·856933	·874071	1015	630·7	576·7	994·7
·723882	·738655	·731121	·745743	1223	759·9	694·9	1199
·707307	·721742	·714380	·728668	1218	756·9	692·1	1194
·705485	·719883	·712540	·726791	1258	781·7	714·8	1233
·644361	·657512	·650805	·663821	1379	856·9	783·5	1352
·598664	·610882	·604651	·616744	1439	894·2	817·6	1410
·581862	·593737	·587681	·599434	1522	945·7	864·8	1492
·557420	·568795	·562993	·574253	1593	989·9	905·1	1561
·513259	·523733	·518391	·528759	1678	1043	953·4	1644
·477878	·487631	·482657	·492310	1853	1151	1053	1816
·473408	·483070	·478143	·487705	1877	1166	1066	1839
·451509	·460724	·456024	·465145	1966	1222	1117	1927
·444906	·453985	·449355	·458342	1935	1202	1099	1896
·390247	·398220	·394149	·402032	2212	1375	1257	2168
·390919	·398897	·394828	·402725	2274	1413	1292	2229
·377581	·385287	·381357	·388985	2345	1457	1332	2298
·362453	·369850	·366077	·373399	2451	1523	1393	2403
·341405	·348373	·344820	·351716	2601	1616	1478	2549
·337525	·344413	·340900	·347718	2558	1590	1453	2507
·305842	·312083	·308900	·315078	2894	1798	1644	2836
·289374	·295280	·292268	·298113	2983	1854	1695	2923
·287205	·293066	·290077	·295879	3094	1923	1758	3032
286382	·292227	·289246	·295031	3103	1928	1763	3041
·267165	·272617	·269836	·275233	3323	2065	1888	3257

TABLE No. 14.—

Wire or Strand L.W.G.	Diam. of Wire		Diam. of Strand		Amperes at 1000 per sq. in.	Amperes I.E.E. rule	Calculated Area sq. in.	Effective Area sq. in.
	inch	mm.	inch	mm.				
1/000000	0·464	11·79	0·464	11·79	169·1	174·6	0·169093	0·169093
37/14	·080	2·032	·560	14·22	183·8	187·0	·185983	·182425
61/16	·064	1·626	·576	14·63	193·9	195·4	·196236	·192444
1/0000000	·500	12·70	·500	12·70	196·3	197·3	·196350	·196350
19/11	·116	2·946	·580	14·73	198·5	199 2	·200798	·197054
7/6	·192	4·877	·576	14·63	200·6	200·9	·202670	·199243
19/10	·128	3·251	·640	16·26	241·7	234·0	·244490	·239931
37/13	·092	2·337	·644	16·36	243·1	235·2	·245962	·241257
61/15	·072	1·829	·648	16·46	245·5	237·0	·248362	·243003
61/14	·080	2·032	·720	18·29	302·9	281·6	·306620	·300696
37/12	·104	2·642	·728	18·49	310·5	287·4	·314311	·308299
61/13	·092	2·337	·828	21·03	400·8	354·3	·405505	·397671
91/14	·080	2·032	880	22·35	451·9	391·0	·457417	·448536
61/12	·104	2·642	·936	23·77	512·0	433·1	·518188	·508177
91/13	·092	2·337	1·012	25·70	597·7	491·7	·604933	·593188
61/11	·116	2·946	1·044	26·52	637·1	518·2	·644666	·632211
91/12	·104	2·642	1·144	29·06	763·8	600·1	·773034	·758025
61/10	·128	3·251	1·152	29·26	775·8	609·0	·784942	·769777
91/11	·116	2·946	1·276	32·41	950·4	719·3	·961715	·943042

STANDARD WIRES AND STRANDS.

Resistance in Ohms per mile at 60° F.				Standard Weight			Minimum Weight
100 per cent. Plain Copper	98 per cent. Plain Copper	100 per cent. Tinn'd Copper	98 per cent. Tinn'd Copper	lb. per mile	lb. per km.	lb. per 1000 yd.	lb. per mile
0·250836	0·255955	0·253345	0·258412	3441	2138	1955	3372
·231970	·236703	·234289	·238975	3830	2380	2176	3753
·219892	·224380	·222091	·226533	4042	2512	2297	3961
·216016	·220424	·218176	·222539	3995	2482	2270	3915
·214749	·219132	·216896	·221234	4134	2569	2349	4051
·212390	·216724	·214514	·218804	4167	2589	2368	4084
·176372	·179971	·178136	·181698	5034	3128	2860	4933
·175402	·178982	·177156	·180700	5066	3148	2878	4965
·174142	·177696	·175883	·179401	5116	3055	2907	5094
·140731	·143602	·142138	·144981	6316	3925	3589	6190
·137260	·140061	·138632	·141405	6474	4023	3678	6345
·106412	·108584	·107452	·109601	8353	5191	4746	8186
·0943452	·0962706	·0952886	·0971944	9422	5855	5353	9234
·0832726	·0949720	·0841053	·0857874	10674	6633	6065	10460
·0713386	·0727945	·0720520	·0734930	12462	7744	7081	12210
·0669352	·0683012	·0676046	·0689566	13279	8252	7545	13010
·0558256	·0569649	·0563839	·0575115	15925	9896	9048	15610
·0549733	·0560952	·0555230	·0566335	16169	10050	9187	15850
·0448730	·0457888	·0453218	·0462282	19811	12310	11256	19410

Table No. 15.—Flexible Conductors.

Conductor L.S.W.G.	Diameter of Wire		Diameter of Strand		Calculated Area	Effective Area	Effective Area	Weight	Resistance in Ohms per Mile at 60° F.			
	in.	mm.	in.	mm.	sq. in.	sq. in.	sq. mm.	lb. per mile	100 % Plain Copper	98 % Plain Copper	100 % Tinned Copper	98 % Tinned Copper
23/40	·0048	·1219	·0259	0·6578	·00041619	·00040843	0·263502	8·614	103·609	105·724	104·645	106·738
15/38	·0060	·1524	·0266	0·6756	·00042403	·000416124	0·268466	8·803	101·693	103·769	102·711	104·765
22/38	·0060	·1524	·0323	0·8205	·00062202	·000610422	0·393820	12·909	69·3245	70·7393	70·0178	71·4181
35/40	·0048	·1219	·0330	0·8370	·00063335	·000621232	0·400794	13·149	68·1182	69·5083	68·7994	70·1754
23/38	·0060	·1524	·0325	0·8255	·00065031	·000638184	0·411731	13·495	66·3087	67·6620	66·9718	68·3113
40/40	·0048	·1219	·0340	0·8636	·00072382	·000709976	0·458048	15·028	59·6037	60·8201	69·1998	61·4038
26/38	·0060	·1524	·0352	0·8940	·00073523	·000721521	0·465496	15·256	58·6500	59·8469	59·2365	60·4212
36/38	·0060	·1524	·0414	1·052	·00101786	·000998392	0·644122	21·123	42·3854	43·2504	42·8092	43·6654
23/36	·0076	·1930	·0422	1·072	·00104338	·00102392	0·660595	21·656	41·3284	42·1718	41·7417	42·5765
40/38	·0060	·1524	·0426	1·082	·00113097	·00110933	0·715700	23·470	38·1464	38·9248	38·5278	39·2984
70/40	·0048	·1219	·0458	1·163	·00126668	·00124221	0·801423	26·299	34·0661	31·7613	34·4067	35·0949
45/38	·0060	·1524	·0463	1·176	·00127209	·00124776	0·805004	26·404	33·9146	34·6067	34·2537	34·9388
100/40	·0048	·1219	·0550	1·397	·00180955	·00177142	1·14478	37·567	23·8485	24·3352	24·0870	24·5687
64/38	·0060	·1524	·0553	1·405	·00180956	·00177460	1·14490	37·550	23·8460	24·3327	24·0815	21·5662
40/36	·0076	·1930	·0555	1·410	·00181456	·00177985	1·14829	37·663	23·7756	24·2609	24·0133	21·4937
100/38	·0060	1524	·0710	1·803	·00282744	·00277254	1·78873	58·681	15·2629	15·5744	15·4155	15·7239
70/36	·0076	·1930	·0720	1·829	·00317552	·00311417	2·00913	65·906	13·5886	13·8659	13·7245	13·9990
113/38	·0060	·1524	·0744	1·890	·00319496	·00313262	2·02101	66·300	13·5085	13·7842	13·6436	13·9165
72/36	·0076	·1930	·0730	1·854	·00326624	·00320314	2·06653	67·794	13·2111	13·4808	13·3433	13·6101

TABLE NO. 15.—FLEXIBLE CONDUCTORS—*continued.*

Conductor L.S.W.G.	Diameter of Wire		Diameter of Strand		Calculated Area	Effective Area	Effective Area	Weight	Resistance in Ohms per Mile at 60° F.			
	in.	mm.	in.	mm.	sq. in	sq. in.	sq. mm.	lb. per mile	100 % Plain Copper	98 % Plain Copper	100 % Tinned Copper	98 % Tinned Copper
75/36	·0076	·1930	·0750	1·905	·00340231	·00333662	2·15265	70·615	12·6823	12·9415	12·8094	13·0657
90/36	·0076	·1930	·0836	2·123	·00408276	·00400349	2·58289	84·742	10·5741	10·7858	10·6757	10·8893
95/36	·0076	·1930	·0860	2·184	·00430964	·00422596	2·72642	89·449	10·0136	10·2179	10·1137	10·3160
176/38	·0060	·1524	·1065	2·705	·00497622	·00487864	3·14751	103·255	8·67396	8·85098	8·76071	8·93592
110/36	·0076	·1930	·0931	2·365	·00499010	·00489321	3·15690	103·571	8·64814	8·82463	8·73462	8·90932
234/38	·0060	·1524	·1230	3·124	·00661611	·00648638	4·18475	137·292	6·52401	6·65715	6·58925	6·72103
298/38	0060	·1524	·1386	3·521	·00848565	·00831927	5·36725	174·848	5·08665	5·19046	5·13752	5·24027
368/38	·0060	·1524	·1540	3·911	·0104049	·0102008	6·58120	215·924	4·14838	4·23305	4·18987	4·27367
99/30	·0124	·3150	·1653	4·199	·0119555	·0117234	7·56345	248·20	3·60964	3·68331	3·64574	3·71865
124/30	·0124	·3150	·1848	4·694	·0149645	·0146387	9·44435	310·87	2·89076	2·94976	2·91967	2·97806
148/30	·0124	·3150	·2018	5·125	·0178731	·0175226	11·3049	371·06	2·41500	2·46428	2·43915	2·48793
173/30	·0124	·3150	·2181	5·540	·0208999	·0204430	13·1890	433·77	2·07001	2·11225	2·09071	2·13252
198/30	·0124	·3150	·2337	5·936	·0239110	·0234421	15·1239	496·40	1·80517	1·84201	1·82322	1·85969
223/30	·0124	·3150	·2479	6·297	·0269301	·0264020	17·0335	559·00	1·60280	1·63551	1·61882	1·65120
248/30	·0124	·3150	·2613	6·638	·0299490	·0293617	18·9430	621·78	1·44123	1·47065	1·45564	1·48479
290/30	·0124	·3150	·2825	7·176	·0350212	·0343345	22·1512	727·00	1·23250	1·25765	1·24482	1·26972
330/30	·0124	·3150	·3017	7·664	·0398516	·0390702	25·2065	827·37	1·08300	1·10521	1·09394	1·11581
370/30	·0124	·3150	·3194	8·113	·0446820	·0438058	28·2618	927·60	0·966017	0·985731	0·975677	0·995190
410/30	·0124	·3150	·3360	8·534	·0495127	·0485418	31·3172	1027·8	0·871767	0·889558	0·880485	0·898049

In the preceding tables, Nos. 12, 13, 14, and 15, the resistance of tinned copper wire has been calculated with a 1 per cent. allowance on all sizes of wire. The Engineering Standards Committee, however, recommend this allowance only for wires No. 12 and No. 28, L.S.W.G., inclusive.

Table No. 16.—Voltage Drop in Copper Conductors.

Cross Section		Yard-ampere for a Voltage drop of (Temperature of Conductor taken as 95° F. = 35° C.):—														
mm.²	sq. in.	0·5 volt	1·0 volt	1·5 volt	2·0 volts	2·5 volts	3·0 volts	3·5 volts	4·0 volts	4·5 volts	5·0 volts	5·5 volts	6·0 volts	7·0 volts	8·0 volts	9·0 volts
1·0	0·00155	29·40	58·8	88·2	117·6	147·0	176·4	205·8	235·2	264·6	294·0	323·4	352·8	411·6	470·4	529·2
1·5	0·002325	44·10	88·2	132·3	176·4	220·5	264·6	308·7	352·75	396·9	441·0	485·1	529·2	617·4	705·6	793·8
2·5	0·003875	73·50	147·0	220·5	294·0	367·5	441·0	514·5	588·0	661·5	735·0	808·5	882·0	1029	1176	1323
4	0·0062	117·6	235·2	352·8	470·3	587·9	705·5	823·0	940·6	1058	1176	1294	1411	1646	1882	2117
6	0·0093	176·4	352·8	529·2	705·6	882·0	1059	1235	1411	1588	1764	1941	2117	2470	2823	3176
10	0·0155	294·0	588·0	882	1176	1470	1764	2058	2352	2646	2940	3234	3528	4116	4704	5292
16	0·0248	470·4	940·8	1411	1881	2352	2822	3292	3763	4234	4704	5174	5645	6586	7526	8467
25	0·0387	735·0	1470	2205	2940	3675	4410	5145	5880	6615	7350	8085	8820	10290	11760	13230
35	0·0542	1029	2058	3087	4116	5145	6174	7202	8231	9260	10290	11320	12350	14405	16463	18520
50	0·0775	1470	2940	4410	5880	7350	8820	10290	11760	13230	14700	16170	17640	20580	23520	26460
70	0·1085	2058	4116	6174	8232	10290	12350	14407	16466	18520	20580	22640	24700	28810	32930	37040
95	0·147	2793	5586	8378	11170	13960	16760	19550	22340	25140	27930	30720	33510	39100	44680	50270
120	0·186	3528	7056	10584	14110	17640	21170	24700	28230	31750	35280	38810	42340	49400	56450	63510
150	0·232	4410	8820	13230	17640	22050	26460	30870	35275	39690	44100	48510	52920	61740	70560	79380
185	0·286	5439	10878	16320	21760	27190	32630	38070	43510	48950	54390	59820	65260	76140	87020	97900
240	0·372	7056	14110	21170	28220	35280	42340	49390	56450	63510	70560	77610	84670	98780	112900	127000
310	0·480	9114	18230	27340	36460	45570	54680	63800	72910	82020	91140	100240	109380	127600	145830	164050
400	0·620	11760	23520	35280	47030	58790	70550	82300	94060	105800	117600	129400	141100	164600	188200	211700
500	0·775	14700	29400	44100	58800	73500	88200	102900	117600	132300	147000	161700	176400	205800	235200	264600
625	0·968	18380	36750	55130	73500	91880	110270	128630	147000	165400	183800	202100	220500	257250	294000	330800
800	1·240	23520	47040	70560	94080	117600	141100	164650	188160	211700	235200	258700	282250	329300	376300	423300
1000	1·550	29400	58800	88200	117600	147000	176400	205800	235200	264600	294000	323400	352800	411600	470400	529200

The above table can be used for any voltage drop, e.g. for 15 volts the 1·5 volt column must be multiplied by ten. By the above table any one of the following quantities can be determined, providing the other three are given: cross section, length in yards (go and return), load in amperes, drop in voltage.

TABLE No. 17.—VOLTAGE DROP

L.S.W.G. or inch	Effective Cross Section		Product of Amperes and Yards for a					
	sq. in.	mm.²	0·5 volt	1·0 volt	1·5 volt	2·0 volts	2·5 volts	3·0 volts
1/22	0·00061575	0·397257	11·7	23·4	35·1	46·7	58·4	70·0
1/21	·00080425	·518870	15·2	30·4	45·7	60·9	76·1	91·4
3/25	·00092400	·596127	17·5	35·0	52·5	70·0	87·6	105·0
1/20	·00101787	·656689	19·3	38·6	57·9	77·2	96·5	115·8
3/24	·00111546	·719655	21·2	42·3	63·5	84·5	106	127
1/19	·00125664	·810900	23·8	47·6	71·5	95·3	119	143
3/23	·00133056	·858423	25·2	50·5	75·8	101	126	152
1/18	·00180956	1·16745	34·3	68·6	103	137	171	206
3/22	·00181103	1·16840	34·4	68·7	103	137	172	206
7/25	·00216193	1·39479	41·0	82·1	123	164	206	246
3/21	·00236534	1·52602	44·9	89·7	135	180	224	269
1/17	·0024630	1·58903	46·8	93·5	140	188	234	281
7/24	·0026099	1·68381	49·5	98·0	148	198	248	297
3/20	·0029937	1·93143	56·9	114	171	228	284	342
7/23	·0031132	2·00850	59·0	118	177	236	296	354
1/16	·0032170	2·07547	60·9	122	183	244	304	366
3/19	·0036960	2·38451	70·1	140	210	280	350	421
1/15	·00407151	2·62677	77·1	154	232	309	386	463
7/22	·00423736	2·73378	80·4	161	241	322	402	482
7/21½	·00486435	3·13829	92·2	184	277	369	461	554
1/14	·00502656	3·24293	95·2	191	286	381	476	572
3/18	·00532223	3·43369	101	202	303	404	505	606
7/21	·00553455	3·57067	104·8	210	314	419	524	629
7/20½	·00588586	3·79732	111·6	223	335	446	558	670
1/13	·00664762	4·28878	126	252	378	504	630	756
7/20	·00700461	4·51909	133	266	399	532	665	797
1/12	·00849488	5·48055	161	322	483	645	806	967
7/19	·00864774	5·57917	164	328	492	655	819	983
1/11	·0105683	6·81824	200	401	601	802	1001	1201
19/22	·0114546	7·39008	217	435	652	870	1087	1304
7/18	·0124556	8·03589	236	473	709	945	1182	1418
1/10	·0128679	8·30185	244	488	732	976	1221	1465
19/21	·0149963	9·67505	284	569	854	1138	1423	1707
1/9	·0162860	10·5071	309	618	927	1236	1545	1854
7/17	·0169495	10·9352	322	643	965	1286	1608	1930
19/20	·0189789	12·2443	360	720	1080	1440	1800	2160
1/8	·0201062	12·9717	381	763	1144	1526	1907	2289
7/16	·0221381	14·2826	420	840	1260	1680	2100	2520
19/19	·0231310	15·1167	444	889	1334	1778	2223	2667

IN COPPER CONDUCTORS.

Voltage Drop of (Temperature taken at 95° F. = 35° C. Yards = lead and return):—

3·5 volts	4·0 volts	4·5 volts	5·0 volts	5·5 volts	6·0 volts	7·0 volts	8·0 volts	9·0 volts
81·7	93·4	105·0	117·0	128·6	140·0	163·7	187	210·0
106·7	121·9	137·1	152·3	167·7	182·8	213·5	244	274·1
122·6	140·0	157·6	175·0	192·7	210·0	245·2	280	315·2
135·0	154·3	173·7	192·9	212·0	232·0	270·0	309	347·0
148	169	190	212	232	254	296	338	380
167	191	214	238	262	286	334	381	429
177	202	227	252	278	303	354	404	455
240	274	308	343	377	412	480	549	617
240	275	309	344	378	412	481	550	618
288	328	370	410	452	493	575	657	740
314	359	404	449	494	539	628	718	808
328	374	421	468	515	561	655	748	842
346	396	445	495	545	594	693	792	891
398	455	512	569	625	682	796	910	1023
413	472	532	590	650	709	827	945	1062
427	487	548	609	670	731	853	975	1097
491	561	631	701	771	841	981	1120	1261
540	617	695	771	848	926	1080	1234	1389
563	643	723	804	884	964	1124	1286	1446
646	738	830	922	1014	1107	1291	1474	1660
667	762	857	952	1048	1142	1333	1524	1714
707	808	908	1010	1110	1211	1413	1617	1818
734	838	943	1048	1152	1258	1468	1678	1888
781	893	1003	1116	1228	1339	1562	1786	2010
882	1007	1133	1260	1385	1511	1763	2017	2267
930	1063	1196	1328	1461	1594	1860	2125	2390
1128	1289	1450	1610	1771	1932	2255	2576	2898
1148	1311	1474	1639	1803	1967	2295	2624	2950
1402	1603	1803	2003	2202	2401	2802	3202	3602
1522	1739	1956	2174	2391	2608	3043	3478	3913
1654	1890	2127	2363	2600	2836	3308	3781	4254
1709	1953	2197	2441	2685	2929	3418	3906	4394
1992	2276	2561	2845	3130	3414	3983	4552	5121
2163	2472	2781	3090	3399	3708	4326	4944	5562
2251	2573	2894	3216	3537	3859	4502	5146	5789
2520	2880	3241	3600	3961	4321	5041	5761	6481
2670	3052	3433	3815	4196	4578	5340	6103	6867
2940	3360	3780	4200	4620	5040	5880	6721	7560
3112	3556	4001	4445	4890	5334	6223	7112	8002

TABLE No. 17.—VOLTAGE DROP

L.S.W.G. or inch	Effective Cross Section		Product of Amperes and Yards for a					
	sq. in.	mm.²	0·5 volt	1·0 volt	1·5 volt	2·0 volts	2·5 volts	3·0 volts
1/7	0·0243285	15·6596	462	923	1385	1847	2308	2770
7/·068″	·0249919	16·1238	474	948	1423	1897	2371	2845
7/15	·0280187	18·0763	532	1063	1595	2127	2658	3190
1/6	·0289529	18·6792	549	1099	1648	2198	2747	3296
19/18	·0337405	21·7680	640	1280	1921	2561	3201	3841
7/14	·0345909	22·3167	656	1313	1969	2625	3282	3938
1/5	·0352990	22·7735	670	1340	2010	2679	3349	4019
37/20	·0369408	23·8327	701	1402	2103	2804	3505	4206
7/·084″	·0381364	24·6041	724	1447	2171	2895	3618	4342
1/4	·0422733	27·2730	802	1604	2406	3209	4011	4813
37/19	·0456064	29·4234	865	1731	2596	3461	4327	5192
7/13	·0457465	29·5138	868	1736	2604	3472	4340	5208
19/17	·0459247	29·6288	871	1743	2614	3486	4357	5229
7/·095″	·0487786	31·4700	926	1851	2777	3702	4628	5554
19/·058″	·0496235	31·7828	942	1883	2825	3766	4708	5649
1/3	·0498760	32·1780	946	1893	2839	3786	4732	5679
7/12	·0584587	37·7152	1109	2219	3328	4437	5547	6656
1/2	·0598286	38·5990	1135	2270	3406	4541	5677	6812
19/16	·0599831	38·6987	1138	2276	3414	4552	5691	6829
37/18	·0656730	42·3696	1246	2492	3738	4984	6231	7477
1/1	·0706860	45·6038	1341	2683	4024	5365	6706	8048
7/11	·0727272	46·9207	1380	2760	4140	5520	6900	8280
19/15	·0759163	48·9781	1441	2881	4322	5763	7203	8644
1/0	·0824481	53·1922	1564	3129	4693	6258	7823	9388
7/10	·0885523	57·1304	1680	3361	5041	6721	8402	10082
37/17	·0893883	57·6697	1696	3392	5089	6785	8481	10178
19/14	·0937239	60·4669	1779	3557	5335	7114	8893	10672
1/00	·0951150	61·3644	1805	3610	5414	7220	9024	10830
19/·082″	·0984681	63·5277	1869	3737	5605	7474	9342	11210
61/18	·108250	69·8389	2054	4108	6162	8216	10270	12326
1/000	·108687	70·119	2062	4125	6187	8249	10312	12376
7/9	·112074	72·3059	2127	4253	6380	8506	10633	12760
37/16	·116752	75·3239	2215	4431	6646	8860	11077	13290
19/13	·123950	79·9676	2352	4704	7055	9408	11760	14112
1/0000	·125664	81·072	2385	4769	7153	9538	11922	14308
7/8	·138363	89·2663	2625	5250	7875	10500	13124	15750
1/00000	·146574	94·562	2781	5562	8342	11125	13906	16686
61/17	·147341	95·0587	2795	5591	8387	11183	13978	16772
37/15	·147764	95·3318	2803	5607	8410	11214	14018	16820

IN COPPER CONDUCTORS—*continued.*

Voltage Drop of (Temperature taken at 95° F. = 35° C. Yards = lead and return)

3·5 volts	4·0 volts	4·5 volts	5·0 volts	5·5 volts	6·0 volts	7·0 volts	8·0 volts	9·0 volts
3231	3693	4154	4616	5077	5539	6462	7386	8308
3320	3794	4268	4742	5217	5691	6640	7588	8536
3722	4253	4785	5316	5848	6380	7443	8506	9570
3846	4395	4944	5494	6043	6592	7692	8790	9889
4482	5122	5762	6402	7042	7683	8962	10243	11523
4594	5251	5907	6563	7220	7876	9189	10500	11816
4689	5358	6029	6698	7368	8038	9378	10717	12057
4906	5608	6309	7010	7710	8411	9813	11214	12617
5065	5789	6512	7236	7959	8683	10130	11577	13024
5615	6417	7219	8021	8824	9626	11230	12834	14440
6058	6923	7788	8654	9519	10385	12115	13846	15577
6076	6944	7812	8680	9548	10416	12152	13888	15624
6100	6972	7843	8714	9586	10458	12200	13942	15686
6479	7404	8330	9256	10182	11107	12958	14810	16660
6591	7533	8474	9416	10358	11300	13182	15066	16950
6625	7572	8518	9465	10411	11357	13250	15142	17036
7765	8874	9984	11093	12203	13311	15530	17748	19968
7947	9082	10218	11352	12488	13623	15894	18164	20436
7966	9105	10243	11381	12520	13657	15934	18210	20487
8723	9970	11216	12460	13708	14954	17447	19938	22432
9389	10730	12072	13413	14754	16097	18778	21460	24143
9660	11040	12420	13800	15180	16560	19320	22080	24840
10085	11525	12966	14408	15847	17288	20170	23050	25932
10952	12518	14082	15645	17210	18774	21903	25032	28162
11763	13442	15122	16802	18485	20163	23527	26884	30244
11873	13570	15266	16962	18658	20354	23750	27140	30533
12450	14230	16010	17790	19566	21343	24900	28460	32017
12634	14440	16245	18048	19853	21660	25270	28880	32490
13080	14950	16817	18686	20550	22420	26160	29900	33634
14380	16430	18486	20542	22596	24650	28755	32864	36975
14438	16500	18560	20625	22688	24750	28873	33000	37124
14886	17013	19140	21266	23390	25520	29770	34030	38280
15510	17720	19937	22150	24370	26584	31014	35445	39872
16464	18816	21168	23520	25870	28220	32930	37630	42335
16690	19076	21460	23846	26230	28610	33380	38150	42920
18375	21000	23626	26250	28870	31500	36750	42000	47250
19467	22250	25030	27810	30590	33370	38936	44496	50060
19570	22365	25160	27955	30750	33546	39140	44730	50320
19623	22430	25230	28035	30840	33640	39250	44850	50470

TABLE No. 17.—VOLTAGE DROP

L.S.W.G. or inch	Effective Cross Section		Product of Amperes and Yards for a					
	sq. in.	mm.²	0·5 volt	1·0 volt	1·5 volt	2·0 volts	2·5 vols	3·0 volts
19/·101″	0·149386	96·3783	2835	5669	8504	11340	14173	17010
19/12	·158393	102·189	3005	6011	9016	12022	15028	18033
1/000000	·169093	109·09	3208	6416	9625	12833	16040	19250
37/14	·182425	117·693	3462	6922	10380	13850	17310	20770
37/·082″	·191660	123·651	3636	7273	10910	14550	18180	21820
61/16	·192444	124·157	3652	7304	10955	14610	18260	21910
1/0000000	·196350	126·68	3726	7452	11180	14900	18630	22350
19/11	·197054	127·131	3739	7478	11220	14960	18700	22430
7/6	·199243	128·543	3781	7562	11340	15120	18900	22685
19/10	·239910	154·794	4552	9104	13660	18210	22760	27310
37/13	·241257	155·649	4578	9156	13730	18310	22890	27470
61/15	·243003	156·776	4611	9222	13830	18450	23060	27670
37/·101″	·290769	187·592	5504	11010	16510	22020	27520	33030
61/14	·300696	193·997	5705	11410	17120	22820	28530	34230
37/12	·308299	198·902	5850	11700	17550	23400	29250	35100
37/·110″	·344898	222·514	6544	13090	19630	26180	32720	39270
37/·118″	·396888	256·056	7531	15060	22590	30120	37660	45190
61/13	·397671	256·561	7545	15090	22635	30180	37730	45270
61/·098″	·451233	291·117	8562	17125	25690	34250	42810	51370
91/14	·448536	289·377	8510	17020	25530	34040	42550	51070
61/·101″	·479282	309·213	9094	18190	27280	36380	45470	54560
61/12	·508177	327·855	9642	19284	28926	38570	48210	57850
61/·108″	·548019	353·560	10400	20800	31200	41600	52000	62400
61/·110″	·573408	369·940	10880	21760	32640	43520	54400	65280
91/13	·593188	382·701	11255	22510	33770	45020	56270	67530
61/11	·632211	407·877	11990	23990	35990	47980	59980	71970
61/·118″	·654201	422·064	12410	24825	37240	49650	62060	74480
91/·098″	·673084	434·247	12770	25540	38320	51090	63860	76640
91/·101″	·714924	461·241	13565	27130	40690	54260	67820	81390
91/12	·758025	489·047	14380	28770	43150	57530	71920	86300
61/10	·769777	496·629	14606	29210	43820	58430	73030	87640
91/11	·943042	608·413	17890	35790	53680	71580	89470	107400
91/·110″	·848013	547·104	16090	32180	48280	64360	80460	96550
91/·118″	·975815	629·576	18520	37030	55550	74060	92580	111100
127/·101″	·997652	643·680	18930	37860	56790	75720	94660	113600

IN COPPER CONDUCTORS—*continued.*

Voltage Drop of (Temperature taken at 95° F. = 35° C. Yards = lead and return)

3·5 volts	4·0 volts	4·5 volts	5·0 volts	5·5 volts	6·0 volts	7·0 volts	8·0 volts	9·0 volts
19840	22680	25510	28348	31180	34010	39680	45350	51020
21040	24040	27050	30055	33060	36065	42080	48090	54100
22460	25670	28880	32085	35290	38500	44920	51330	57750
24230	27690	31150	34620	38080	41530	48470	55380	62310
25450	29090	32730	36360	40000	43640	50910	58180	65460
25560	29210	32870	36520	40170	43820	51130	58420	65730
26080	29810	33530	37260	40980	44710	52160	59610	67060
26170	29910	33650	37390	41130	44870	52340	59820	67300
26470	30250	34030	37810	41590	45370	52930	60490	68060
31870	36420	40970	45520	50080	54630	63740	72840	81940
32040	36620	41200	45780	50360	54940	64090	73240	82400
32280	36890	41500	46110	50720	55340	64560	73780	83000
38530	44030	49540	55040	60550	66050	77060	88060	99080
39940	45640	51350	57050	62760	68470	79880	91290	102700
40950	46800	52650	58500	64350	70200	81900	93600	105300
45810	52360	58900	65440	71980	78540	91620	104700	117800
52720	60250	67780	75310	82840	90370	105430	120500	135600
52820	60360	67900	75450	82990	90540	105600	120700	135800
59930	68500	77060	85620	94180	102740	119870	137000	154100
59580	68080	76600	85100	93620	102130	119160	136180	153200
63660	72750	81840	90940	100100	109100	127300	145500	163700
67500	77140	86780	96420	106070	115700	135000	154300	173550
72790	83200	93580	104000	114400	124800	145600	166400	187200
76160	87040	97920	108800	119700	130600	152300	174100	195860
78780	90040	101300	112550	123800	135070	157570	180100	202600
83960	95960	108000	119900	131950	144000	167900	191900	215950
86880	99300	111700	124100	136500	149000	173800	198600	223400
89400	102200	114940	127700	140500	153300	178800	204300	229900
94950	108500	122100	135650	149200	162800	189900	217000	244200
100700	115060	129460	143800	158200	172600	201400	230150	258900
102240	116840	131450	146060	160700	175300	204500	233700	262900
125250	143150	161040	178900	196800	214700	250500	286300	322100
112650	128700	144800	160900	177000	193100	225300	257500	289700
129600	148150	166700	185200	203700	222200	259300	296300	333300
132500	151460	170400	189300	208300	227200	265100	302900	340800

The voltage drop for any copper conductor can be worked out from the following formula :—

Let V = voltage drop.
A = current in amperes.
L = length of circuit (go and return) in yards.
R = resistance of the conductor.
S = cross section of conductor in square mm.

Taking the working temperature as 95° F., at which temperature copper has a specific resistance of $1 \cdot 86 \times 10^{-6}$ ohms per cubic centimetre, then :—

$$R = \frac{0 \cdot 0186\ L}{1 \cdot 094\ S}$$

$$\therefore V = AR = \frac{0 \cdot 0186\ LA}{1 \cdot 094\ S} = 0 \cdot 0170\ \frac{LA}{S}$$

If the section is expressed in square inches, the voltage drop is—

$$V = 0 \cdot 00002635\ \frac{LA}{S}$$

Table No. 18.—Weight and Resistance (Standard) of Soft Annealed Copper Wire.

Diameter, mm.	Section, square mm.	Standard Weight, lb. per mile	Standard Resistance ohms per mile	Diameter, mm.	Section, square mm.	Standard Weight, lb. per mile	Standard Resistance, ohms per mile
0·05	0·00196	0·0621	13630	0·45	0·1590	5·030	168·25
·06	·00283	·0894	9464	·46	·1662	5·256	161·00
·07	·00385	·1217	6952	·48	·1810	5·723	147·88
·08	·00503	·1590	5324	·50	·1963	6·210	136·29
·09	·00636	·2012	4206	·52	·2124	6·717	126·00
·10	·00785	·2484	3407	·54	·2290	7·242	116·84
·12	·0113	·3577	2366	·55	·2376	7·516	112·64
·14	·0154	·4868	1738	·56	·2463	7·788	108·64
·15	·0177	·5589	1514·2	·58	·2642	8·356	101·29
·16	·0201	·6359	1331·0	·60	·2827	8·942	94·63
·18	·0254	·8048	1051·5	·62	·3019	9·549	88·62
·20	·0314	·9936	851·6	·64	·3217	10·174	83·18
·22	·0380	1·202	703·9	·65	·3318	10·493	80·64
·24	·0452	1·431	591·4	·66	·3421	10·82	78·21
·25	·0491	1·553	545·1	·68	·3632	11·49	73·68
·26	·0531	1·679	504·0	·70	·3848	12·17	69·52
·28	·0616	1·947	434·5	·72	·4072	12·88	65·72
·30	·0707	2·236	378·6	·74	·4301	13·60	62·22
·32	·0804	2·544	332·7	·75	·4418	13·97	60·57
·34	·0908	2·872	294·7	·76	·4536	14·35	58·99
·35	·0962	3·043	278·1	·78	·4778	15·11	55·99
·36	·1018	3·219	262·9	·80	·5027	15·90	53·24
·38	·1134	3·587	235·9	·82	·5281	16·70	50·67
·40	·1257	3·974	212·9	·84	·5542	17·53	48·29
·42	·1385	4·381	193·15	·85	·5675	17·95	47·16
·44	·1521	4·808	176·00	·86	·5809	18·37	46·07

TABLE No. 18.—WEIGHT AND RESISTANCE (STANDARD) OF SOFT ANNEALED COPPER WIRE—*continued.*

Diameter, mm.	Section, square mm.	Standard Weight, lb. per mile	Standard Resistance ohms per mile	Diameter, mm.	Section, square mm.	Standard Weight, lb. per mile	Standard Weight ohms per mile
0·88	0·6082	19·24	43·99	2·2	3·801	120·22	7·039
·90	·6362	20·12	42·06	2·3	4·155	131·40	6·440
·92	·6648	21·03	40·26	2·4	4·524	143·08	5·914
·94	·6940	21·95	38·56	2·5	4·909	155·24	5·451
·95	·7088	22·42	37·75	2·6	5·309	167·90	5·040
·96	·7238	22·89	36·972	2·7	5·726	181·09	4·673
·98	·7543	23·86	35·474	2·8	6·158	194·74	4·346
1·00	·7854	24·84	34·066	2·9	6·605	208·90	4·050
1·05	·8659	27·38	30·900	3·0	7·069	223·56	3·786
1·10	·9503	30·06	28·157	3·1	7·548	238·70	3·546
1·15	1·0387	32·85	25·760	3·2	8·042	254·36	3·327
1·20	1·1310	35·77	23·659	3·3	8·553	270·50	3·128
1·25	1·2272	38·80	21·803	3·4	9·079	287·14	2·947
1·30	1·3273	41·97	20·160	3·5	9·621	304·27	2·781
1·35	1·4314	45·26	18·694	3·6	10·179	321·90	2·6286
1·40	1·5394	48·68	17·381	3·7	10·752	340·04	2·4886
1·45	1·6513	52·22	16·206	3·8	11·341	358·63	2·3594
1·50	1·7671	55·88	15·143	3·9	11·946	377·74	2·2399
1·55	1·8869	59·67	14·183	4·0	12·566	397·40	2·1292
1·60	2·0106	63·58	13·310	4·1	13·203	417·50	2·0266
1·65	2·138	67·62	12·515	4·2	13·854	438·10	1·9314
1·70	2·270	71·78	11·790	4·3	14·522	459·22	1·8427
1·75	2·405	76·07	11·126	4·4	15·205	480·84	1·7599
1·80	2·545	80·48	10·516	4·5	15·904	502·93	1·6826
1·85	2·688	85·02	9·954	4·6	16·619	525·52	1·6100
1·90	2·835	89·67	9·437	4·7	17·349	548·64	1·5422
1·95	2·986	94·46	8·961	4·8	18·096	572·22	1·4788
2·00	3·142	99·35	8·517	4·9	18·857	596·33	1·4191
2·1	3·464	109·54	7·726	5·0	19·635	620·98	1·3630

RESISTANCE OF COPPER CONDUCTORS TO ALTERNATING CURRENT.

Owing to the eddy currents induced in conductors by the passage of alternating current, the current density becomes a minimum along the axis of the conductor and a maximum near its surface (skin effect). This unequal current density causes an increase in the electrical resistance, which increase can be calculated by a formula given by Lord Kelvin.* The following table has been calculated from Lord Kelvin's formula by Hospitalier and Potier for copper of standard resistance.

Let d = diameter of copper conductor in centimetres.
p = periodicity per second.
R = resistance to continuous current.
Then kR = resistance to alternating current.

* Presidential Address to Inst.E.E., 1889.

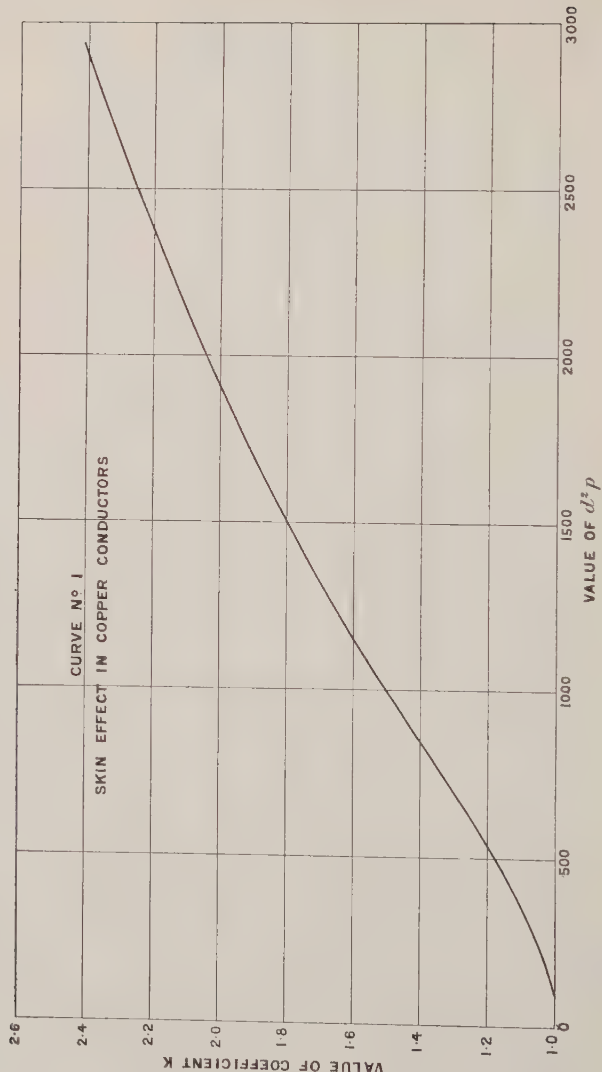
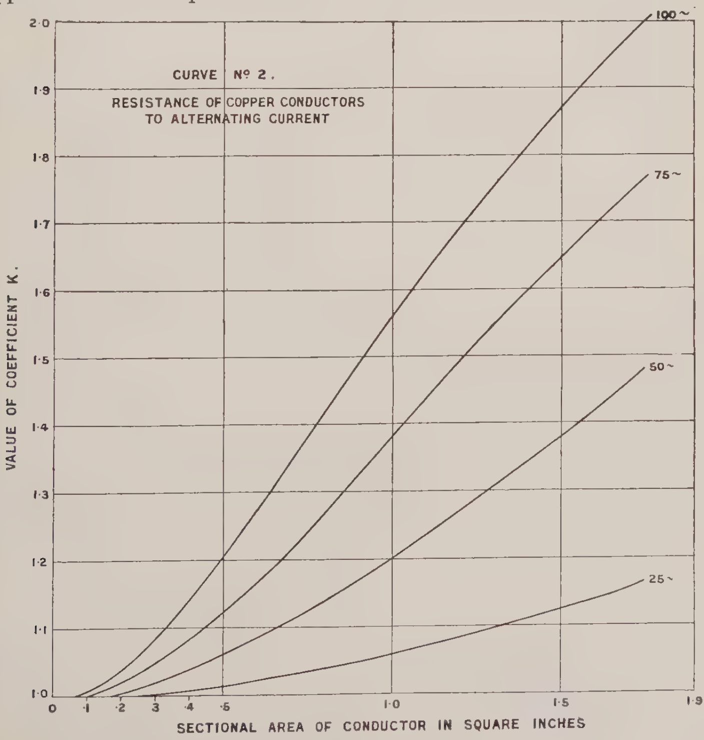

CURVE No. I
SKIN EFFECT IN COPPER CONDUCTORS
VALUE OF $d^2 p$
0
500
1000
1500
2000
2500
3000
VALUE OF COEFFICIENT K
1·0
1·2
1·4
1·6
1·8
2·0
2·2
2·4
2·6

TABLE No. 19.—ALTERNATING CURRENT RESISTANCE COEFFICIENT FOR STANDARD COPPER.

d^2p	k	d^2p	k
0	1·0000	1280	1·6778
20	1·0000	1620	1·8628
80	1·0001	2000	2·0430
180	1·0258	2420	2·2190
320	1·0805	2880	2·3937
500	1·1747	5120	3·0956
720	1·3180	8000	3·7940
980	1·4920	18000	5·5732

Curve No. 1 has been constructed from the values given in Table No. 19.

Curve No. 2 shows the value of the coefficient k for various sections of copper and for various periodicities.



In the case of large copper sections for use with alternating current, it may be advisable to insulate alternate wires in the strand by means of a layer of paper, in order to reduce the eddy currents.

Concentric Conductors.

The diameter and number of the wires necessary to form a concentric conductor of any cross-sectional area can be found in the following way:—

Let Q = section of conductor in square mm.
N = number of wires,
D = diameter over insulation of inner conductor,
d = diameter of each wire (both in mm.).

$$\text{Then } Q = \frac{\pi d^2 N}{4} \quad \therefore \quad N = \frac{4\,Q}{\pi d^2}$$

The pitch diameter of the outer conductor will be $(D + d)$ and the pitch circumference $\pi (D + d)$; therefore the number of wires will be

$$N = \frac{\pi (D + d)}{d}$$

Equating these two equations for N, we get:—

$$\frac{4\,Q}{\pi d^2} = \frac{\pi (D + d)}{d} \quad \therefore \quad d (D + d) = \frac{4\,Q}{\pi^2}$$

$$\therefore \quad d^2 + D\,d + \frac{D^2}{4} = \frac{4\,Q}{\pi^2} + \frac{D^2}{4} = \frac{1{\cdot}625\,Q + D^2}{4}$$

$$\therefore \quad d + \frac{D}{2} = \tfrac{1}{2}\sqrt{(1{\cdot}625\,Q + D^2)}$$

$$\therefore \quad d = \tfrac{1}{2}\sqrt{(1{\cdot}625\,Q + D^2)} - \frac{D}{2}$$

A variation of 5 per cent. is generally allowed between the resistance of the various conductors in concentric cables.

In the case of concentric cables of large cross section the outer conductor is sometimes formed of segmental copper strips, thereby reducing the diameter and cost of insulating and armouring materials.

TABLE No 20.—TEMPERATURE COEFFICIENTS FOR COPPER.

The resistance of copper at 60° F. is equal to the resistance at t° F. multiplied by the coefficient for t° F.

t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient
25	1·0796	38	1·0493	51	1·0199	64	0·9914
·5	1·0784	·5	1·0482	·5	1·0188	·5	·9903
26	1·0772	39	1·0470	52	1·0177	65	·9893
·5	1·0760	·5	1·0459	·5	1·0166	·5	·9882
27	1·0749	40	1·0447	53	1·0154	66	·9871
·5	1·0737	·5	1·0436	·5	1·0143	·5	·9860
28	1·0725	41	1·0425	54	1·0132	67	·9849
·5	1·0713	·5	1·0413	·5	1·0121	·5	·9839
29	1·0702	42	1·0402	55	1·0110	68	·9828
·5	1·0689	·5	1·0390	·5	1·0099	·5	·9818
30	1·0679	43	1·0379	56	1·0088	69	·9807
·5	1·0667	·5	1·0368	·5	1·0077	·5	·9797
31	1·0655	44	1·0356	57	1·0066	70	·9786
·5	1·0643	·5	1·0345	·5	1·0055	·5	·9775
32	1·0632	45	1·0334	58	1·0044	71	·9765
·5	1·0620	·5	1·0322	·5	1·0033	·5	·9754
33	1·0609	46	1·0312	59	1·0022	72	·9744
·5	1·0597	·5	1·0299	·5	1·0011	·5	·9733
34	1·0585	47	1·0289	60	1·0000	73	·9722
·5	1·0574	·5	1·0277	·5	0·9989	·5	·9712
35	1·0562	48	1·0266	61	·9978	74	·9702
·5	1·0551	·5	1·0255	·5	·9968	·5	·9691
36	1·0539	49	1·0244	62	·9957	75	·9681
·5	1·0528	·5	1·0232	·5	·9946		
37	1·0516	50	1·0221	63	·9935		
·5	1·0505	·5	1·0210	·5	·9925		

Table No 21.—Temperature Coefficients for Copper.

(As used by Continental Engineers.)

The resistance of copper at 15° C. is equal to the resistance at t° C. multiplied by the coefficient for t° C.

t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient
0	1·0577	9	1·0226	18	0·9889	27	0·9566
·5	1·0558	·5	1·0207	·5	·9871	·5	·9549
1	1·0538	10	1·0188	19	·9853	28	·9531
·5	1·0518	·5	1·0169	·5	·9834	·5	·9514
2	1·0498	11	1·0150	20	·9816	29	·9497
·5	1·0478	·5	1·0131	·5	·9798	·5	·9479
3	1·0459	12	1·0112	21	·9780	30	·9463
·5	1·0439	·5	1·0094	·5	·9762	·5	·9445
4	1·0420	13	1·0075	22	·9744	31	·9427
·5	1·0400	·5	1·0056	·5	·9726	·5	·9410
5	1·0381	14	1·0037	23	·9708	32	·9392
·5	1·0361	·5	1·0019	·5	·9690	·5	·9376
6	1·0342	15	1·0000	24	·9673	33	·9359
.5	1·0322	·5	0·9981	·5	·9650	·5	·9342
7	1·0303	16	·9963	25	·9637	34	·9326
·5	1·0283	·5	·9944	·5	·9620	·5	·9309
8	1·0264	17	·9926	26	·9602	35	·9292
·5	1·0245	·5	·9908	·5	·9584		

TABLE No 22.—ELONGATION TESTS ON ANNEALED COPPER WIRE.

The following tests show the elongation of high conductivity annealed copper wire when subjected to gradually increasing strain:—

Diam. inch	Elongation in 10 inches =	0·5 per cent.	1 per cent.	2 per cent.	3 per cent.	5 per cent.	7·5 per cent.	10 per cent.	15 per cent.	20 per cent.	Breaking Strain	Total Elongation
												per cent.
0·039	Strain in lb. =	21·5	24·33	26·5	28·33	32·0	34·83	36·5	38·33	40·67	42·83	30·13
·049	„ „ =	30·67	37·67	43·5	46·0	50·83	55·5	59·33	64·33	68·0	71·33	34·5
·059	„ „ =	50·67	58·17	62·17	67·17	74·0	81·5	86·17	94·67	99·33	104·17	34·33
·070	„ „ =	68·67	80·0	87·0	93·33	103·67	112·67	119·67	130·0	136·5	143·33	35·17
·078	„ „ =	81·33	92·0	101·0	108·83	123·17	138·17	146·67	160·83	169·83	178·0	37·17
·088	„ „ =	108·0	123·0	137·5	149·67	167·33	179·0	189·5	207·0	217·0	225·0	33·5
·101	„ „ =	135·67	159·67	175·33	187·0	206·67	224·67	243·0	264·67	280·0	290·0	29·67
·120	„ „ =	201·33	222·33	243·0	258·33	285·67	312·0	337·33	367·67	387·67	404·0	36·33
·142	„ „ =	271·0	298·33	327·67	352·0	395·0	435·0	471·0	516·67	545·67	566·0	31·33
·161	„ „ =	316·0	347·67	391·67	428·0	487·67	546·33	593·33	658·0	696·0	726·0	36·33
·179	„ „ =	486·0	534·0	564·67	586·33	630·33	666·33	699·33	752·0	786·33	821·33	39·5
·217	„ „ =	600·0	650·33	717·0	770·0	858·67	940·33	1007·67	1110·33	1173·67	1232·67	37·33
·235	„ „ =	613·0	663·67	723·33	777·33	877·33	972·0	1055·33	1172·0	1245·67	1327·33	36·5

TABLE No. 23. MECHANICAL TESTS ON HARD DRAWN COPPER WIRES.

Diameter of Wire		Tensile Strength		Elongation per cent.	Twists in		Bends (complete) over Quadrant of	
millimetres	mils	kg/mm²	lb. per sq. in.		75 mm.	150 mm.	5 mm. radius	10 mm. radius
3·015	119	45·7	65000	1·33	14	18	4/5	..
4·00	157·5	42·2	60000	2·66	12·5	15·5	..	6/7
4·25	167	44·1	62720	0·66	8·5	14·5	..	6
5·01	197	43·2	61440	2·33	9·5	15·5	..	6
8·00	315	40·8	58030	3·0	..	14·5	..	2/3

PRICE OF COPPER WIRE.

The price of any copper wire can be separated into two parts, viz., the Basis and the Extra. The *basis* price is equal to the market price of copper plus the price of the rolling and preliminary drawing, which is approximately £4 per ton. The *extra* price covers the drawing into finer wires and also the tinning. The price of tinning copper is approximately £3 per ton up to basis size. Table No. 24 gives a typical Continental "extras" list. The prices given are in shillings per 100 kilogrammes.

TABLE No. 24.—COPPER EXTRAS.

Diameter of Wire in mm.	Extra for Plain Copper	Extra for Double Tinned Copper	Extra for Winding on Spools	Diameter of Wire in mm.	Extra for Plain Copper	Extra for Double Tinned Copper	Extra for Winding on Spools
to 1·40	0	6·00	1·45	0·15	10	62	6·4
1·39–1·10	1·50	9·80	1·45	·14	12	76	8·5
1·09–0·80	2·50	10·00	1·45	·13	15	96	11·0
0·79–0·70	3·50	10·50	1·45	·12	18	126	14·5
0·69–0·60	3·75	10·75	1·45	·11	22	156	18
0·59–0·50	4·00	11·0	1·45	·10	26	186	22
0·49–0·40	4·00	11·0	1·55	·095	30	260	30
0·39–0·36	4·25	12·0	1·75	·090	40	360	40
0·35–0·33	4·50	14·0	1·90	·085	50	460	53
0·32–0·30	4·75	15·0	2·10	·080	60	560	72
0·29–0·27	5·00	16·0	2·30	·075	80	710	108
0·26–0·24	5·25	17·5	2·65	·070	100	860	132
0·23–0·21	5·50	19·0	3·00	·065	150	1010	150
0·20	5·75	19·0	3·25	·060	225	1210	180
0·19	6·25	28·0	3·50	·055	350	1360	240
0·18	7·00	34·0	4·10	·050	450	1510	300
0·17	8·00	45·0	4·70	·045	600	1810	455
0·16	9·00	51·0	5·40	·040	800	2210	600

Up to 0·10 mm. diameter the wire is usually delivered in hanks.

The following list is a typical "extras" list of English manufacturers, the prices given being in pence per lb.

TABLE No. 25.—COPPER EXTRAS.

Diameter inch	Plain	Single Tinned	Double Tinned	Remarks	Diameter inch	Plain	Single Tinned	Double Tinned	Remarks
to ·080	0	$\frac{3}{4}$	$1\frac{1}{8}$	In hank	·019 –·0164	$1\frac{1}{4}$	3	$4\frac{1}{2}$	In hank
·079–·056	0	1	$1\frac{1}{2}$		·0163–·0124	$1\frac{1}{2}$	$3\frac{1}{4}$	5	
·055–·048	$\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{7}{8}$		·0123–·0116	$2\frac{1}{4}$	6	..	
·047–·036	$\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$		·0115–·0100	$2\frac{1}{4}$	$7\frac{1}{2}$	..	
·035–·032	$\frac{1}{2}$	$1\frac{3}{4}$	$2\frac{5}{8}$		·0090–·0084	$2\frac{1}{2}$	..	..	
·031–·028	$\frac{3}{4}$	2	3		·0083–·0076	$2\frac{3}{4}$	..	..	
·027–·022	1	$2\frac{1}{4}$	$3\frac{3}{8}$		·0075–·0068	$3\frac{1}{4}$	..	..	
·021–·020	1	$2\frac{1}{2}$	$3\frac{3}{4}$		·0067–·0058	4	..	..	

Winding on drums up to 0·036 in. . . $\frac{1}{2}d.$ per lb.
Winding on reels ,, 0·0124 in. . . 1$d.$ per lb.

Owing to the fluctuations of the copper market the prices in cable estimates are generally protected by a Copper Clause similar to the following: –

"Above prices of cable are subject to fluctuations of Copper market for Electrolytic Copper, and will be regulated according to the prices published in the last issue of the 'Mining Journal' prior to the date when the official order is received.

"Based on £ per ton.

"For every variation in the price of Copper £1 per ton the price of the cable will be varied at the rate of £9 per square inch and per mile."

TABLE No. 26.—TABLE SHOWING THE AMOUNT TO BE ADDED TO OR SUBTRACTED FROM THE COST OF A CABLE BY A RISE OR FALL IN THE PRICE OF COPPER.

Basis.—Copper at 120/– per 100 kilogrammes. Difference given in shillings per kilometre and per conductor.

Conductor Area		1	2	3	4	5	6	7	8	9	10
sq. mm.	sq. inch	$\frac{121}{119}$	$\frac{122}{118}$	$\frac{123}{117}$	$\frac{124}{116}$	$\frac{125}{115}$	$\frac{126}{114}$	$\frac{127}{113}$	$\frac{128}{112}$	$\frac{129}{111}$	$\frac{130}{110}$
6	0·0093	0·55	1·10	1·65	2·20	2·75	3·30	3·85	4·40	4·95	5·50
10	·0155	0·90	1·80	2·70	3·60	4·50	5·40	6·30	7·20	8·10	9·00
16	·0248	1·45	2·90	4·35	5·80	7·25	8·70	10·15	11·60	13·05	14·50
25	·0387	2·25	4·50	6·75	9·00	11·25	13·50	15·75	18·00	20·25	22·50
35	·0542	3·10	6·20	9·30	12·40	15·50	18·60	21·70	24·80	27·90	31·00
50	·0775	4·45	8·90	13·35	17·80	22·25	26·70	31·15	35·60	40·05	44·50
70	·1085	6·25	12·50	18·75	25·00	31·25	37·50	43·75	50·00	56·25	62·50
95	·147	8·45	16·90	25·35	33·80	42·25	59·70	59·15	67·60	76·05	84·50
120	·186	10·70	21·40	32·10	42·80	53·50	64·20	74·90	85·60	96·30	107·0
150	·232	13·35	26·70	40·05	53·40	66·75	80·10	93·45	106·8	120·15	133·5
185	·286	16·45	32·90	49·35	65·80	82·25	98·70	115·15	131·6	148·05	164·5
210	·325	18·70	37·40	56·10	74·80	93·50	112·2	130·90	149·6	168·30	187·0
240	·372	21·35	42·70	64·05	85·40	106·75	128·1	149·45	170·8	192·15	213·5
280	·434	24·90	49·80	74·70	99·60	124·50	149·4	174·3	199·2	224·1	249·0
310	·480	27·60	55·20	82·80	110·4	138·0	165·6	193·2	220·8	248·4	276·0
355	·550	31·60	63·20	94·80	126·4	158·0	189·6	221·2	252·8	284·4	316·0
400	·620	35·60	71·20	106·8	142·4	178·0	213·6	249·2	281·8	320·4	356·0
500	·775	44·50	89·00	133·5	178·0	222·5	267·0	311·5	356·0	400·5	445·0
625	·968	55·60	111·2	166·8	222·4	278·0	333·6	389·2	444·8	500·4	556·0
725	1·123	64·50	129·0	193·5	258·0	322·5	387·0	451·5	516·0	580·5	645·0
800	1·240	71·15	142·3	213·5	284·6	355·8	426·9	498·1	569·2	640·4	711·5
1000	1·550	89·00	178·0	267·0	356·0	445·0	531·0	623·0	712·0	801·0	890·0

TABLE No. 26—*continued.*

Conductor Area		11	12	13	14	15	16	17	18	19	20
sq. mm.	sq. inch	$\frac{131}{109}$	$\frac{132}{108}$	$\frac{133}{107}$	$\frac{134}{106}$	$\frac{135}{105}$	$\frac{136}{104}$	$\frac{137}{103}$	$\frac{138}{102}$	$\frac{139}{101}$	$\frac{140}{100}$
6	0·0093	6·05	6·60	7·15	7·70	8·25	8·80	9·35	9·90	10·45	11·0
10	·0155	9·90	10·80	11·70	12·60	13·50	14·40	15·30	16·20	17·10	18·0
16	·0248	15·95	17·40	18·85	20·30	21·75	23·20	21·65	26·10	27·55	29·0
25	·0387	24·75	27·00	29·25	31·50	33·75	36·00	38·25	40·50	42·75	45·0
35	·0542	34·10	37·20	40·30	43·40	46·50	49·60	52·70	55·80	58·90	62·0
50	·0775	48·95	53·40	57·85	62·30	66·75	71·20	75·65	80·10	84·55	89·0
70	·1085	68·75	75·00	81·25	87·50	93·75	100·0	106·3	112·5	118·8	125·0
95	·147	92·95	101·4	109·9	118·3	126·8	135·2	143·7	152·1	160·6	169·0
120	·186	117·7	128·4	139·1	149·8	160·5	171·2	181·9	192·6	203·3	214·0
150	·232	146·9	160·2	173·6	186·9	200·3	213·6	227·0	240·3	253·7	267·0
185	·286	181·0	197·4	213·9	230·3	246·8	263·2	279·7	296·1	312·6	329·0
210	·325	205·7	224·4	243·1	261·8	280·5	299·2	317·9	336·6	355·3	374·0
240	·372	234·9	256·2	277·6	298·9	320·3	341·6	363·0	384·3	405·7	472·0
280	·434	273·9	298·8	323·7	348·6	373·5	398·4	423·3	448·2	473·1	498·0
310	·480	303·6	331·2	358·8	386·4	414·0	441·6	469·2	496·8	524·4	552·0
355	·550	347·6	379·2	410·8	442·4	474·0	505·6	537·2	568·8	600·4	632·0
400	·620	391·6	427·2	462·8	498·4	531·0	569·6	605·2	610·8	676·4	712·0
500	·775	489·5	534·0	578·5	623·0	667·5	712·0	756·5	801·0	845·5	890·0
625	·968	611·6	667·2	722·8	778·4	834·0	889·6	945·2	1001·0	1057·0	1112·0
725	1·123	709·5	774·0	838·5	903·0	967·5	1032·0	1097·0	1161·0	1226·0	1290·0
800	1·240	782·7	853·8	925·0	996·1	1067·0	1139·0	1210·0	1281·0	1352·0	1423·0
1000	1·550	979·0	1068·0	1157·0	1246·0	1335·0	1424·0	1513·0	1602·0	1691·0	1780·0

TABLE No. 26—*continued.*

Conductor Area		21	22	23	24	25	26	27	28	29	30
sq. mm.	sq. inch	$\frac{141}{99}$	$\frac{142}{98}$	$\frac{143}{97}$	$\frac{144}{96}$	$\frac{145}{95}$	$\frac{146}{94}$	$\frac{147}{93}$	$\frac{148}{92}$	$\frac{149}{91}$	$\frac{150}{90}$
6	0·0093	11·55	12·10	12·65	13·20	13·75	14·30	14·85	15·40	15·95	16·5
10	·0155	18·90	19·80	20·70	21·60	22·50	23·40	24·30	25·20	26·10	27·0
16	·0248	30·45	31·90	33·35	34·80	36·25	37·70	39·15	40·60	42·05	43·5
25	·0387	47·25	49·50	51·75	54·00	56·25	58·50	60·75	63·00	65·25	67·5
35	·0542	65·10	68·20	71·30	74·40	77·50	80·60	83·70	86·80	89·90	93·0
50	·0775	93·45	97·90	102·4	106·8	111·3	115·7	120·2	124·6	129·1	133·5
70	·1085	131·3	137·5	143·8	150·0	156·3	162·5	168·8	175·0	181·3	187·5
95	·147	177·5	185·9	194·4	202·8	211·3	219·7	228·2	236·6	245·1	253·5
120	·186	224·7	235·4	246·1	256·8	267·5	278·2	288·9	299·6	310·3	321·0
150	·232	280·4	293·7	307·1	320·4	333·8	347·1	360·5	373·8	387·2	400·5
185	·286	345·5	361·9	378·4	394·8	411·3	427·7	444·2	460·6	477·1	493·5
210	·325	392·7	411·4	430·1	448·8	467·5	486·2	504·9	523·6	542·3	561·0
240	·372	448·4	469·7	491·1	512·4	533·8	555·1	576·5	597·8	619·2	640·5
280	·434	522·9	547·8	572·7	597·6	622·5	647·4	672·3	697·2	722·1	747·0
310	·480	579·6	607·2	634·8	662·4	690·0	717·6	745·2	772·8	800·4	828·0
355	·550	663·6	695·2	726·8	758·4	790·0	821·6	853·2	884·8	916·4	948·0
400	·620	747·6	783·2	818·8	854·4	890·0	925·6	961·2	996·8	1032·0	1068·0
500	·775	934·5	979·0	1024·0	1068·0	1113·0	1157·0	1202·0	1246·0	1291·0	1335·0
625	·968	1168·0	1223·0	1279·0	1334·0	1390·0	1446·0	1501·0	1557·0	1612·0	1668·0
725	1·123	1355·0	1419·0	1484·0	1548·0	1613·0	1677·0	1742·0	1806·0	1871·0	1935·0
800	1·240	1494·0	1565·0	1637·0	1708·0	1779·0	1850·0	1921·0	1992·0	2063·0	2134·0
1000	1·550	1869·0	1959·0	2047·0	2136·0	2225·0	2314·0	2103·0	2492·0	2581·0	2670·0

TABLE NO. 26—*continued.*

Conductor Area		31	32	33	34	35	36	37	38	39	40
sq. mm.	sq. inch	$\frac{151}{89}$	$\frac{152}{88}$	$\frac{153}{87}$	$\frac{154}{86}$	$\frac{155}{85}$	$\frac{156}{84}$	$\frac{157}{83}$	$\frac{158}{82}$	$\frac{159}{81}$	$\frac{160}{80}$
6	0·0093	17·05	17·60	18·15	18·70	19·25	19·80	20·35	20·90	21·45	22·0
10	·0155	27·90	28·80	29·70	30·60	31·50	32·40	33·30	34·20	35·10	36·0
16	·0248	44·95	46·40	47·85	49·30	50·75	52·20	53·65	55·10	56·55	58·0
25	·0387	69·75	72·00	74·25	76·50	78·75	81·00	83·25	85·50	87·75	90·0
35	·0542	96·10	99·20	102·3	105·4	108·5	111·6	114·7	117·8	120·9	124·0
50	·0775	137·95	142·40	146·9	151·3	155·8	160·2	164·7	169·1	173·6	178·0
70	·1085	193·75	200·00	206·3	212·5	218·8	225·0	231·3	237·5	243·8	250·0
95	·147	261·95	270·40	278·9	287·3	295·8	304·2	312·7	321·1	329·6	338·0
120	·186	331·70	342·40	353·1	363·8	374·5	385·2	395·9	406·6	417·3	428·0
150	·232	413·85	427·20	440·6	453·9	467·3	480·6	494·0	507·3	520·7	534·0
185	·286	509·95	526·40	542·9	559·3	575·8	592·2	608·7	625·1	641·6	658·0
210	·325	579·70	598·40	617·1	635·8	654·5	673·2	691·9	710·6	729·3	748·0
240	·372	661·85	683·20	704·6	725·9	747·3	768·6	790·0	811·3	832·7	854·0
280	·434	771·90	796·80	821·7	846·6	871·5	896·4	921·3	946·2	971·1	996·0
310	·480	855·6	883·2	910·8	938·4	966·0	993·6	1021·0	1049·0	1076·0	1104·0
355	·550	979·6	1011·0	1043·0	1074·0	1106·0	1138·0	1169·0	1201·0	1232·0	1264·0
400	·620	1104·0	1139·0	1175·0	1210·0	1246·0	1282·0	1317·0	1353·0	1388·0	1424·0
500	·775	1379·0	1424·0	1468·0	1513·0	1557·0	1602·0	1646·0	1691·0	1735·0	1780·0
625	·968	1724·0	1779·0	1835·0	1890·0	1946·0	2002·0	2057·0	2113·0	2168·0	2224·0
725	1·123	1999·0	2064·0	2128·0	2193·0	2257·0	2322·0	2386·0	2451·0	2515·0	2580·0
800	1·240	2206·0	2277·0	2348·0	2419·0	2490·0	2561·0	2633·0	2704·0	2775·0	2846·0
1000	1·550	2759·0	2848·0	2937·0	3026·0	3115·0	3204·0	3293·0	3382·0	3471·0	3560·0

TABLE NO. 26—*continued.*

Conductor Area		41	42	43	44	45	46	47	48	49	50
sq. mm.	sq. inch	$\frac{161}{79}$	$\frac{162}{78}$	$\frac{163}{77}$	$\frac{164}{76}$	$\frac{165}{75}$	$\frac{166}{74}$	$\frac{167}{73}$	$\frac{168}{72}$	$\frac{169}{71}$	$\frac{170}{70}$
6	0·0093	22·55	23·10	23·65	24·20	24·75	25·30	26·05	26·60	27·15	27·5
10	·0155	36·90	37·80	38·70	39·60	40·50	41·40	42·30	43·20	44·10	45·0
16	·0248	59·45	60·90	62·35	63·80	65·25	66·70	68·15	69·60	71·05	72·5
25	·0387	92·25	94·50	96·75	99·00	101·3	103·5	105·8	108·0	110·3	112·5
35	·0542	127·1	130·2	133·3	136·4	139·5	142·6	145·7	148·8	151·9	155·0
50	·0775	182·5	186·9	191·4	195·8	200·3	204·7	209·1	213·6	218·1	222·5
70	·1085	256·3	262·5	268·8	275·0	281·3	287·5	293·7	300·0	306·3	312·5
95	·147	346·5	354·9	363·4	371·8	380·3	388·7	397·1	405·6	414·1	422·5
120	·186	438·7	449·4	460·1	470·8	481·5	492·2	502·9	513·6	524·3	535·0
150	·232	547·4	560·7	574·1	587·4	600·8	614·1	627·5	640·8	654·1	667·5
185	·286	674·5	690·9	707·4	723·8	740·3	756·7	773·2	789·6	806·1	822·5
210	·325	766·7	785·4	804·1	822·8	841·5	860·2	878·9	897·6	916·3	935·0
240	·372	875·4	896·7	918·1	939·4	960·5	982·1	1003·0	1025·0	1046·0	1067·0
280	·434	1021·0	1046·0	1071·0	1096·0	1121·0	1145·0	1170·0	1195·0	1220·0	1245·0
310	·480	1132·0	1159·0	1187·0	1214·0	1242·0	1270·0	1297·0	1325·0	1352·0	1380·0
355	·550	1296·0	1327·0	1359·0	1390·0	1422·0	1454·0	1485·0	1517·0	1548·0	1580·0
400	·620	1460·0	1495·0	1531·0	1566·0	1602·0	1638·0	1673·0	1709·0	1744·0	1780·0
500	·775	1824·0	1869·0	1913·0	1958·0	2002·0	2047·0	2091·0	2136·0	2180·0	2225·0
625	·968	2280·0	2335·0	2391·0	2446·0	2502·0	2558·0	2613·0	2669·0	2724·0	2780·0
725	1·123	2644·0	2709·0	2773·0	2838·0	2902·0	2967·0	3031·0	3096·0	3160·0	3225·0
800	1·240	2917·0	2988·0	3059·0	3131·0	3202·0	3273·0	3374·0	3415·0	3486·0	3557·0
1000	1·550	3649·0	373[illegible]·0	3827·0	3916·0	4005·0	4094·0	4183·0	4272·0	4361·0	4450·0

TABLE No. 26—*continued.*

Conductor Area		51	52	53	54	55	56	57	58	59	60
sq. mm.	sq. inch	$\frac{171}{69}$	$\frac{172}{68}$	$\frac{173}{67}$	$\frac{174}{66}$	$\frac{175}{65}$	$\frac{176}{64}$	$\frac{177}{63}$	$\frac{178}{62}$	$\frac{179}{61}$	$\frac{180}{60}$
6	0·0093	28·05	28·60	29·15	29·70	30·25	30·80	31·35	31·90	32·45	33·0
10	·0155	45·90	46·80	47·70	48·60	49·50	50·40	51·30	52·20	53·10	54·0
16	·0248	73·95	75·40	76·85	78·30	79·75	81·20	82·45	84·10	85·55	87·0
25	·0387	114·7	117·0	119·2	121·5	123·8	126·0	128·2	130·5	132·7	135·0
35	·0542	158·1	161·2	164·3	167·4	170·5	173·6	176·7	179·8	182·9	186·0
50	·0775	226·9	231·4	235·8	240·3	244·7	249·2	253·6	258·1	262·6	267·0
70	·1085	318·7	325·0	331·2	337·5	343·7	350·0	356·2	362·5	368·7	375·0
95	·147	430·9	439·4	447·8	456·3	464·7	473·2	481·6	490·1	498·6	507·0
120	·186	545·7	556·4	567·1	577·8	588·5	599·2	609·9	620·6	631·3	642·0
150	·232	680·8	694·2	707·6	720·9	734·2	747·6	760·9	774·3	787·6	801·0
185	·286	838·9	855·4	871·8	888·3	904·7	921·2	937·6	954·1	970·6	987·0
210	·325	953·7	972·4	991·1	1010·0	1028·0	1047·0	1066·0	1085·0	1103·0	1122·0
240	·372	1089·0	1110·0	1132·0	1153·0	1174·0	1196·0	1217·0	1238·0	1260·0	1281·0
280	·434	1270·0	1295·0	1320·0	1345·0	1369·0	1394·0	1419·0	1444·0	1469·0	1494·0
310	·480	1408·0	1435·0	1463·0	1490·0	1518·0	1546·0	1573·0	1601·0	1628·0	1656·0
355	·550	1612·0	1643·0	1675·0	1706·0	1738·0	1770·0	1801·0	1833·0	1864·0	1896·0
400	·620	1816·0	1851·0	1887·0	1922·0	1958·0	1994·0	2029·0	2065·0	2100·0	2136·0
500	·775	2269·0	2314·0	2358·0	2403·0	2447·0	2492·0	2536·0	2581·0	2625·0	2670·0
625	·968	2836·0	2891·0	2947·0	3002·0	3058·0	3114·0	3169·0	3225·0	3280·0	3336·0
725	1·123	3289·0	3354·0	3418·0	3483·0	3547·0	3612·0	3676·0	3741·0	3805·0	3870·0
800	1·240	3629·0	3700·0	3771·0	3842·0	3913·0	3984·0	4056·0	4127·0	4198·0	4269·0
1000	1·550	4539·0	4628·0	4717·0	4806·0	4895·0	4984·0	5073·0	5162·0	5251·0	5340·0

(B) Aluminium.

Aluminium wire can now be commercially obtained having a conductivity of 63 per cent. as compared with annealed copper of equal section; therefore, for equal conductivity the area of aluminium will be 1·59 times the area of annealed copper, or 1·556 times the area of hard-drawn copper.

The specific gravity of pure aluminium is 2·58, cast aluminium 2·64, rolled aluminium 2·68, drawn aluminium 2·71; therefore, for equal conductivity the weight of aluminium will be 0·483 times the weight of annealed copper, or 0·473 times the weight of hard-drawn copper, and for equal area the weight of aluminium will be 0·304 times the copper weight.

For equal conductivity the diameter of aluminium will be 1·26 times the diameter of annealed copper, or 1·247 times the diameter of hard-drawn copper.

The basis for the comparison of the prices of copper and aluminium is given by the formula:

$$\frac{\text{Specific Gravity of Copper} \times \text{Conductivity of Aluminium}}{\text{Specific Gravity of Aluminium} \times \text{Conductivity of Copper}} \frac{\times \text{ Price of Copper}}{\times \text{ Price of Aluminium}}$$

Therefore, the cost of a conductor of given conductivity will be the same for aluminium and copper when the price of aluminium is 2·072 times the price of annealed copper, or 2·114 times the price of hard-drawn copper. If aluminium is cheaper than these values, it will be economical to use it as far as the conductor itself is concerned. For an insulated cable, however, the larger diameter of the aluminium conductor would, except in the case of extra high-tension cables, require more insulating material, etc., and therefore these ratios would be materially altered.

In the case of an overhead transmission line these ratios would have to be modified, to allow for the increased wind pressure owing to the larger diameter of the aluminium conductor, and also to allow for the different tensile strength of copper and aluminium. The tensile strength of aluminium varies between 18,000 and 28,000 lb. per square inch, as against 54,000 to 62,000 lb. per square inch for hard-drawn copper. The elastic limit in each case lies at 40–50 per cent. of the tensile strength.

The mean tensile strength of aluminium is, therefore, about 0·4 times that of hard-drawn copper, or, for equal conductivity, 0·62 times that of hard-drawn copper; but for any given span the weight of aluminium would be only 0·473 times that of hard-drawn copper of equal conductivity; whilst, on the other hand, the coefficient of expansion for aluminium is 0·00002354, as compared with 0·0000165 for hard-drawn copper. Therefore, aluminium has an advantage of approximately 50 per cent. in the length of span if higher poles are used than for copper, or, with equal sag, this advantage reduces to about 25 per cent. in favour of aluminium. But, when the wind pressure is considered, aluminium has a disadvantage of 1·247 times the diameter of copper for equal conductivity; therefore, for an overhead line with a given sag, the length of span for aluminium and for hard-drawn copper would be approximately the same.

Up to the elastic limit the elongation of aluminium is from 0·14 to 0·16 per cent., and 0·15 per cent. for hard-drawn copper.

The total elongation of aluminium is about 7 per cent., and 0·7 to 3·5 per cent. for hard-drawn copper.

By means of the above given ratios the foregoing tables for copper conductors can be applied to aluminium.

The melting-point of aluminium is about 650° C.

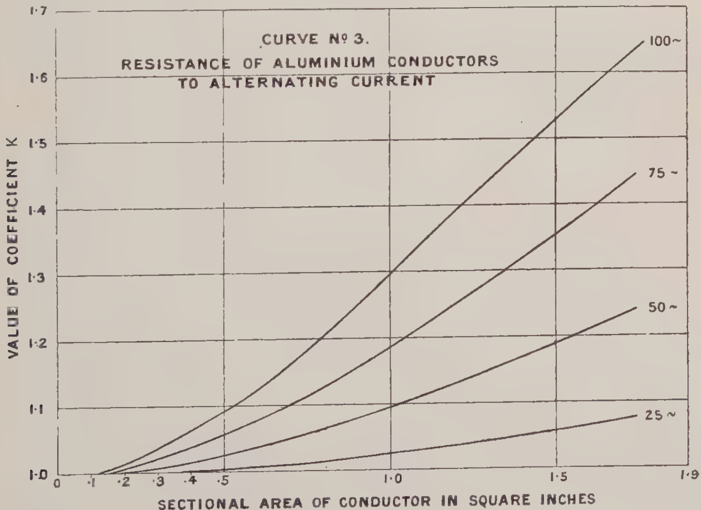
Table No. 27 gives some average mechanical tests on aluminium wire.

TABLE No. 27.—MECHANICAL TESTS ON ALUMINIUM WIRE.

Diameter in mm.	Tensile Strength		Number of Twists		Number of Complete Bends over Quadrant		Elongation in 150 mm. per cent.
	Kilogrammes per sq. mm.	Lb. per sq. inch	In 75 mm.	In 150 mm.	Of Radius 5 mm.	Of Radius 10 mm.	
2·64	20·1	28590	13½	22	9	19	5·3
4·01	18·6	26450	14½	22½	7	11	4·7
5·50	16·6	23610	13	30	6	10	7·4
7·0	14·0	19910	..	31	..	8	6·5
9·0	15·2	21620	..	22	..	6	5·3
10·0	12·6	17920	..	19	..	5	9·0

RESISTANCE OF ALUMINIUM CONDUCTORS TO ALTERNATING CURRENT.

The increased resistance of aluminium conductors carrying alternating current (due to skin effect) is equal to k R, where R is the resistance to continuous current, and k is a coefficient depending upon the diameter of the conductor and the periodicity of the current. Curve No. 3 gives the value of k for various aluminium conductors and periodicities.



Aluminium is highly electro-positive, and therefore should be used as little as possible in contact with other metals, especially in damp and exposed positions.

The conductivity of aluminium varies greatly with the purity; thus, a wire of 99·6 per cent. purity had a conductivity of 64 per cent. of that of copper,

while a similar wire, but of 99·0 per cent. purity, had a conductivity of only 61 per cent. The purest commercial aluminium consists of 99·6 per cent. aluminium, 0·3 per cent. iron, and 0·1 per cent. silicon.

Table No. 28.—Temperature Coefficients for Aluminium.

The resistance of aluminium at 15° C., is equal to the resistance at t° C., multiplied by the coefficient for t° C.

t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient
0·0	1·0577	9·0	1·0226	18·0	0·9889	27·0	0·9566
0·5	1·0558	9·5	1·0207	18·5	·9871	27·5	·9549
1·0	1·0538	10·0	1·0188	19·0	·9853	28·0	·9531
1·5	1·0518	10·5	1·0169	19·5	·9834	28·5	·9514
2·0	1·0498	11·0	1·0150	20·0	·9816	29·0	·9497
2·5	1·0478	11·5	1·0131	20·5	·9798	29·5	·9479
3·0	1·0459	12·0	1·0112	21·0	·9780	30·0	·9463
3·5	1·0439	12·5	1·0094	21·5	·9762	30·5	·9445
4·0	1·0420	13·0	1·0075	22·0	·9744	31·0	·9427
4·5	1·0400	13·5	1·0056	22·5	·9726	31·5	·9410
5·0	1·0381	14·0	1·0037	23·0	·9708	32·0	·9392
5·5	1·0361	14·5	1·0019	23·5	·9690	32·5	·9376
6·0	1·0342	15·0	1·0000	24·0	·9673	33·0	·9359
6·5	1·0322	15·5	0·9981	24·5	·9650	33·5	·9342
7·0	1·0303	16·0	·9963	25·0	·9637	34·0	·9326
7·5	1·0283	16·5	·9944	25·5	·9620	34·5	·9309
8·0	1·0264	17·0	·9926	26·0	·9602	35·0	·9292
8·5	1·0245	17·5	·9908	26·5	·9584	..	..

CHAPTER II.

IMPREGNATED PAPER INSULATION.

The specific gravity of cable paper averages 0·80, although some cable manufacturers calculate with a specific gravity as high as 1·10, which allows for the greater proportionate waste of insulating paper as compared with the other materials used in the manufacture of cables.

The paper used generally consists of Manila fibre, hemp fibre, and wood cellulose (chemical wood pulp), in various proportions. At one time it was thought necessary to specify that the paper should consist of pure Manila fibre, but experiments and experience have proved that such limitation is not necessary and even not advisable, for mixtures of Manila fibre with wood cellulose produce papers equally suitable for cable work and possessing probably greater tensile strength; moreover, the cellulose paper is much cheaper than the Manila fibre paper. Cable paper should, however, not contain mechanical wood pulp, esparto, jute or straw.

Table No. 29 shows the results of tests carried out by the Versuchsanstalt Berlin (1901) on various papers, to determine their durability and suitability

TABLE No. 29.—TESTS ON PAPER.

Width of Paper in mm.	Breaking Strain in Kilogrammes.		Elongation in per cent.		Breaking Length in Metres		Difference after 24 hours drying at 135° C.		Amount of Moisture in Paper during Tensile Test		Composition of the Paper
	Before drying	After 24 hours drying at 135° C.	Before drying	After 24 hours drying at 135° C.	Before drying	After 24 hours drying at 135° C.	Breaking Strain per cent.	Elongation per cent.	Before drying per cent.	After drying per cent.	per cent.
10	4·61	4·26	1·9	1·7	5050	4650	- 8	- 11	8·6	8·0	Manila .. 65 Cellulose .. 30 Rag stuff .. 5
10	5·73	5·40	2·7	2·2	8200	7700	- 6	- 19	9·2	8·2	Manila .. 65 Cellulose .. 35
10	5·46	4·88	2·3	1·8	6400	5800	- 9	- 22	8·5	7·4	Manila .. 50 Cellulose .. 50
10	4·79	4·67	2·4	2·1	5650	5500	−3	- 13	9·0	8·1	Manila .. 70 Cellulose .. 25 Rag stuff .. 5
19·5	10·91	11·32	1·5	1·6	4500	4575	+2	+7	8·0	6·31	Cellulose .. 100

with regard to the insulating of cables. The tests were in two series, the first being conducted on the papers in their commercial state, that is to say, without being subjected to any drying or other operation; the second series of tests was carried out on the papers after they had been artificially aged by long drying and heating, and allowed to regain their original amount of moisture.

The figures given for the first four samples are really mean values of ten tests in each case; the figures given for the last sample are the means of twenty tests.

The tensile tests were carried out on strips of paper 180 mm. long, at a temperature of 19° C. and 65 per cent. humidity of air.

The quality of paper, with reference to cable manufacture, can be relatively determined by measuring the distance that oil is sucked up by the paper. Strips of the papers are supported in a small frame over a bath of cable-impregnating oil, which bath is adjustable on standards to any height on the frame. The temperature of the oil is raised to say 100° C., and maintained at that temperature throughout the test. When the oil has assumed the chosen temperature, the bath is raised (or the papers lowered) so that the strips of paper dip into the oil; the suction height is measured at intervals of say 10, 30 and 60 minutes.

Table No. 30 shows a set of tests on various papers used in cable manufacture, the "breaking length" is the length of paper which, when supported at one end, would break owing to its own weight. These tests were carried out on the papers as received, without being subjected to any drying or other operation.

TABLE No. 30.—TESTS ON INSULATING PAPER.

Width of Strip in mm.	Thickness in mm.	Breaking Length in Metres	Elongation per cent.	Tensile Strength, kg. sq. m.	Suction Height in Millimetres for Castor Oil at 100° C. after			Weight, kg. sq. m.	Specific Gravity
					10 mins.	30 mins.	60 mins.		
25	0·15	8000	1·75	5·23	8	11	15	0·096	0·64
30	·155	8440	1·86	5·59	8	11	15	·1010	0·65
35	·155	7620	1·66	4·83	8	11	15	·0959	0·62
..	·10	4710	3·00	2·76	..	..	11·5	..	..
..	·15	3210	3·70	2·50	..	..	10·5	..	..
..	·22	6250	1·50	4·47	..	..	16·5	..	..
..	·13/·15	6270	2·15	4·31	..	..	13·0	..	..
..	·135	8210	2·20	6·66	..	..	15·1	..	..

Paper used in the manufacture of impregnated paper cables varies between 0·08 and 0·16 mm. (3·1 and 6·3 mils) in thickness; it is advisable not to use paper of greater thickness than 0·16 mm., whilst numerous experiments on cables insulated with papers of various thicknesses show very conclusively the superiority of thin paper with respect to bending qualities and dielectric strength. In the case of high-tension cables with a total thickness of paper of 5 or 6 mm. or more, the use of thin paper is to be strongly recommended.

The paper, after being cut into strips, is spirally lapped on to the conductor with a slight overlap, so that the successive layers break joint with one another. The layers are usually applied in one direction, so that all the layers can be lapped on by means of one "cage" in one operation. When insulated with the requisite thickness of paper, the cable is placed in the drying-pan and dried under vacuum at a temperature of about 135° C. (275° F.) for from 12 to 30 hours, according to the thickness of the paper insulation. The cable is next

impregnated with insulating compound at a temperature of about 116° C. (241° F.) for from 4 to 30 hours, after which it is fed direct from the pan through the lead press or bitumen forcing machine, as the case may require.

The paper insulated core is sometimes taped with one layer of fine cotton tape, which increases the diameter by 0·6 mm. Such a tape is distinctly beneficial in the case of extra high tension cables, as it reduces the liability of the paper layers to crack when the cable is bent; coloured tapes allow of the cores being easily identified in the case of multicore cables. Another method of identification of the cores in multicore cables is to provide the conductors with one, two, or more tinned-copper wires respectively in place of the plain copper wires.

Thickness of Paper Insulation.

The thickness of paper required to insulate a conductor for a given working pressure varies with the size of the conductor and with the factor of safety allowed. Theoretically the required thickness of insulation diminishes with increasing cross section of conductor, but for mechanical reasons the thickness should increase with increasing size of the conductor. These variations approximately balance one another on low and high tension cables—that is to say, for any given factor of safety and for any given working pressure (up to certain limits) the thickness of paper insulation should be approximately the same for all sizes of conductor. In the case of extra high tension cables above say, 10,000 volts, the increased thickness required for mechanical reasons is overbalanced by the decrease of thickness allowable by reason of the less peaked nature of the electric stress curve with increasing cross section of conductor; therefore a less thickness is required for large conductors than for small conductors. The theoretical value for the paper thickness can be determined from the following formula:—

Let V = working pressure in volts
r = radius of conductor in mm.
R = radius over paper insulation in mm.
x = distance from centre to point P in mm.
S = stress at point P in volts per mm.

then

$$S = \frac{0 \cdot 434\, V}{x \log_{10} \frac{R}{r}}.$$

If the insulation consists of a homogeneous material, the stress will be a maximum at the surface of the conductor, therefore with $x = r$

$$S = \frac{0 \cdot 434\, V}{r \log_{10} \frac{R}{r}}.$$

For example:

Let $V = 20{,}000$ volts, and the maximum stress allowable $S = 3000$ volts per millimetre; then:

(i) for a conductor section of 0·05 square inch

$$r = 7 \cdot 26 \text{ mm., and } R = 18 \cdot 1 \text{ mm.};$$

therefore the required thickness of insulation = 10·8 mm.

(ii) for a conductor section of 0·25 square inch

$$r = 16 \cdot 45 \text{ mm., and } R = 24 \cdot 54 \text{ mm.};$$

therefore the required thickness of insulation = 8·09 mm.

The maximum thickness of paper allowable in any case with the present
thicknesses the outer layers of paper are liable to crack when the cable is bent,
with advantage, be subjected to a preliminary impregnation previous to its

TABLE No. 31.—PAPER THICKNESSES RECOMMENDED

Cross Section of Conductor		Single, Concentric and Triple Conc. for 660 Volts		Concentric for 2200 volts				Concentric for 3300 volts				Concentric for 6600 volts				Concentric for 11,000 volts			
				Inner		Outer, if Earthed		Inner		Outer, if Earthed		Inner		Outer, if Earthed		Inner		Outer, if Earthed	
sq. in.	sq. mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
·025	16·13	80	2·03	120	3·05	80	2·03	150	3·81	90	2·29	230	5·84	100	2·54	350	8·89	120	3·05
·050	32·26	80	2·03	120	3·05	80	2·03	150	3·81	90	2·29	230	5·84	100	2·54	350	8·89	120	3·05
·075	48·4	80	2·03	120	3·05	80	2·03	150	3·81	90	2·29	230	5·84	100	2·54	350	8·89	120	3·05
·100	64·5	90	2·29	130	3·30	90	2·29	160	4·06	100	2·54	240	6·10	110	2·79	360	9·14	120	3·05
·125	80·6	90	2·29	130	3·30	90	2·29	160	4·06	100	2·54	240	6·10	110	2·79	360	9·14	120	3·05
·150	96·8	90	2·29	130	3·30	90	2·29	160	4·06	110	2·79	240	6·10	120	3·05	360	9·14	120	3·05
·200	129	90	2·29	130	3·30	90	2·29	160	4·06	110	2·79	240	6·10	120	3·05	360	9·14	120	3·05
·250	161	100	2·54	140	3·56	100	2·54	170	4·32	110	2·79	250	6·35	120	3·05	370	9·40	120	3·05
·300	193	100	2·54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·350	226	100	2·54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·400	258	100	2·54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·500	322	100	2·54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·600	387	110	2·79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·700	451	110	2·79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·750	484	110	2·79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·800	516	120	3·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·900	581	120	3·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1·00	645	130	3·30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Two and Three Core Cables.—For ordinary working the cables are to be in-
between conductors and lead case. For three-phase working with the star point
column B the thickness between conductors and lead.

impregnating practice is approximately 18 to 20 mm.; even with these and the inner layers of paper are liable to scanty impregnation; the paper may, application to the cable.

BY THE ENGINEERING STANDARDS COMMITTEE.

2 and 3 Core ·660 volts		2 and 3 Core 2200 volts				2 and 3 Core 3300 volts				2 and 3 Core 6600 volts				2 and 3 Core 11,000 volts			
		A		B		A		B		A		B		A		B	
mils	mm.	mils	mm.	mils	mm	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm	mils	mm.
90	2·29	130	3·30	100	2·54	150	3·81	120	3·05	230	5·84	170	4·32	350	8·89	230	5·84
90	2·29	130	3·30	100	2·54	150	3·81	120	3·05	230	5·84	170	4·32	350	8·89	230	5·84
90	2·29	130	3·30	100	2·54	150	3·81	120	3·05	230	5·84	170	4·32	350	8·89	230	5·84
100	2·54	140	3·56	110	2·79	160	4·06	130	3·30	240	6·10	180	4·57	360	9·14	240	6·10
100	2·54	140	3·56	110	2·79	160	4·06	130	3·30	240	6·10	180	4·57	360	9·14	240	6·10
100	2·54	140	3·56	110	2·79	160	4·06	130	3·30	240	6·10	180	4·57	360	9·14	240	6·10
100	2·54	140	3·56	110	2·79	160	4·06	130	3·30	240	6·10	180	4·57	360	9·14	240	6·10
110	2·79	150	3·81	120	3·05	170	4·32	140	3·56	250	6·35	190	4·83	370	9·40	250	6·35
110	2·79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
110	2·79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
110	2·79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
110	2·79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

sulated with the thickness shown in column A, both between conductors and earthed, column A gives the insulation thickness between conductors, and

The thickness of paper insulation for general cables up to 11,000 volts working pressure has recently been standardised by the Engineering Standards Committee; Table No. 31 gives the thickness of insulation as recommended by this Committee for various cables.

Table No. 32 gives the thickness of paper insulation for various low tension cables as recommended by the Institution of Electrical Engineers.

Table No. 33 gives the thickness of paper insulation for various low tension (up to 700 volts working pressure) cables as recommended by the Verband Deutscher Elektrotechniker, the thickness of insulation for higher working pressures being left for the manufacturer to decide.

Table No. 34 gives the thickness of paper insulation as generally used by the Continental cable manufacturers; the insulation thickness is not usually increased with increasing size of conductor, except in the case of low tension cables.

Table No. 35 gives the thickness of paper insulation recommended by H. W. Fisher in his paper read before the American Institution of Electrical Engineers (1905).

TABLE No. 32.—THICKNESS OF PAPER INSULATION FOR LOW TENSION CABLES.

(As recommended by the Institution of Electrical Engineers.)

Conductor, L.S.W.G. or in.	Conductor Section		Paper Thickness		Conductor, L.S.W.G. or in.	Conductor Section		Paper Thickness	
	sq. in.	sq. mm.	mils	mm.		sq. in.	sq. mm.	mils	mm.
7/18	0·012456	8·036	80	2·03	19/·101″	0·14939	96·378	90	2·29
7/17	·016949	10·935	80	2·03	37/14	·18242	117·69	90	2·29
19/20	·018979	12·244	80	2·03	37/·082″	·19166	123·65	90	2·29
7/16	·022138	14·283	80	2·03	37/·092″	·24126	155·65	100	2·54
19/19	·023431	15·117	80	2·03	37/·101″	·29077	187·59	100	2·54
7/·068″	·024992	16·124	80	2·03	37/·110″	·34490	222·51	100	2·54
7/15	·028019	18·076	80	2·03	61/13	·39767	256·56	100	2·54
19/18	·033740	21·768	80	2·03	61/·098″	·45123	291·12	100	2·54
7/14	·034591	22·317	80	2·03	61/·101″	·47928	309·21	100	2·54
19/17	·045925	29·629	80	2·03	61/·108″	·54802	353·56	110	2·79
7/·095″	·048778	31·470	80	2·03	61/·110″	·57341	369·94	110	2·79
19/·058″	·049623	31·783	80	2·03	61/·118″	·65420	422·06	110	2·79
19/16	·059983	38·699	80	2·03	91/·098″	·67308	434·25	110	2·79
19/15	·075916	48·978	80	2·03	91/·101″	·71492	461·24	110	2·79
19/14	·093724	60·467	90	2·29	91/12	·75802	489·05	120	3·05
19/·082″	·098468	63·528	90	2·29	91/·110″	·84801	547·10	120	3·05
37/16	·11675	75·324	90	2·29	91/·118″	·97584	629·58	130	3·30
19/13	·12395	79·967	90	2·29	127/·101″	·99765	643·68	130	3·30
37/15	·14776	95·332	90	2·29					

TABLE No. 33.—THICKNESS OF PAPER INSULATION FOR CABLES UP TO 700 VOLTS PRESSURE. (As recommended by the Verband Deutscher Elektrotechniker.)

Cross Section of Conductor		Single Cable		Concentric and Multicore Cable	
square mm.	square inch	mm.	mils	mm.	mils
1·0	0·00155	1·75	69	2·3	90·7
1·5	·00232	1·75	69	2·3	90·7
2·5	·00387	1·75	69	2·3	90·7
4·0	·0062	1·75	69	2·3	90·7
6	·0093	1·75	69	2·3	90·7
10	·0155	1·75	69	2·3	90·7
16	·0248	2·00	79	2·3	90·7
25	·0387	2·00	79	2·3	80·7
35	·0542	2·00	79	2·3	90·7
50	·0775	2·00	79	2·3	90·7
70	·1085	2·00	79	2·3	90·7
95	·147	2·00	79	2·3	90·7
120	·186	2·00	79	2·3	90·7
150	·232	2·25	88·5	2·3	90·7
185	·286	2·25	88·5	2·5	98·5
240	·372	2·50	98·5	2·5	98·5
310	·480	2·50	98·5	2·8	110
400	·620	2·50	98·5	2·8	110
500	·775	2·75	108	..	..
625	·968	2·75	108	..	..
800	1·240	3·00	118	..	..
1000	1·550	3·00	118	..	..

TABLE No. 34.—THICKNESS OF PAPER INSULATION. (Continental practice.)

Type of Cable.		Paper Thickness	
		mm.	mils
Single, concentric, and multicore	660 volts	1·5 to 2·0	59·2 to 78·8
" " "	750 "	1·75 " 2·3	69·0 " 90·7
" " "	1000 "	2·0 " 2·3	78·8 " 90·7
" " "	2000 "	2·25 " 3·3	88·5 " 130
" " "	3000 "	2·5 " 4·5	98·5 " 177
Single and multicore ..	4000 "	5·0	197
" "	5000 "	5·5 to 6·0	216 to 236
" "	6000 "	6·0 " 7·0	236 " 276
" "	7000 "	7·0	276
" "	10000 "	8·5 to 10·0	335 to 394
" "	11500 "	9·0	354
" "	16000 "	12·5	493
" "	20000 "	14 to 16	552 to 630

Concentric cables are not used for working pressures higher than 3000 volts.

TABLE No. 35.—THICKNESS OF PAPER INSULATION. (As recommended by H. W. Fisher.*)

Working Pressure in Volts	Paper Thickness mm.	Paper Thickness mils
1000 to 1900	3·18 to 3·97	125 to 156
1900 „ 2250	3·97 „ 4·76	156 „ 188
2250 „ 3800	4·76 „ 5·56	188 „ 219
3800 „ 5000	5·56 „ 6·35	219 „ 250
5000 „ 6500	6·35 „ 7·94	250 „ 312
6500 „ 8000	7·16 „ 8·75	282 „ 345
8000 „ 9500	7·94 „ 9·55	312 „ 376
9500 „ 11000	8·75 „ 10·3	345 „ 406
11000 „ 13000	9·55 „ 11·1	376 „ 437
13000 „ 15000	10·3 „ 11·9	406 „ 470
15000 „ 17000	11·1 „ 12·7	437 „ 500
17000 „ 19000	11·9 „ 13·5	470 „ 532
19000 „ 21000	12·7 „ 14·3	500 „ 564
21000 „ 23000	13·5 „ 15·1	532 „ 595

WEIGHT OF PAPER.

If d = the diameter of the conductor in millimetres, and D = the diameter of the insulated core in millimetres, then the weight of paper is equal to—

$$\text{kilogrammes per kilometre} = \frac{\pi}{4}(D^2 - d^2) \times \text{specific gravity}.$$

Taking the specific gravity of paper as 0·8, this equation reduces to—

$$\text{kilogrammes per kilometre} = 0{\cdot}63\,(D^2 - d^2);$$

or,

$$\text{lb. per statute mile} = 2{\cdot}23\,(D^2 - d^2).$$

If the diameters D and d be given in inches, then the weight of paper will be—

$$\text{kilogrammes per kilometre} = 406\,(D^2 - d^2);$$

or,

$$\text{lb. per statute mile} = 1440\,(D^2 - d^2).$$

Table No. 36 gives the weight of paper in kilogrammes per kilometre, based, however, on a specific gravity of 1·10, as used in several large cable works. This table is used as follows—

E.g.: 0·46 square inch conductor insulated with 3 mm. of paper.
Conductor 0·46 sq. in. = strand of 37 × 3·19 mm. (from Copper Table).
Diameter of strand = 7 × 3·19 = 22·33 mm.
Therefore, diameter over paper = 22·33 + 6 = 28·33 mm.

Weight of paper for diameter of 28·33 mm. = 696·8 kilog.
„ „ „ 22·33 mm. = 433·5 „

Therefore, weight of the paper annulus per kilometre = 263·3 „

Therefore, weight of paper per statute mile = 263·3 × 3·548 = 934 lb.

To obtain the bare weight of paper (specific gravity 0·80) these values must be multiplied by $\frac{0{\cdot}80}{1{\cdot}10} = 0{\cdot}727$.

* Proceedings of the American Inst. E.E., vol. xxiv. p. 687.

TABLE No. 36.—WEIGHT OF PAPER IN KILOGRAMMES PER KILOMETRE.
(Specific Gravity 1·10.)

Diam. in mm.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
1	0·9	1·1	1·3	1·5	1·7	2·0	2·3	2·5	2·8	3·2
2	3·5	3·9	4·2	4·6	5·0	5·4	5·9	6·3	6·8	7·3
3	7·8	8·4	8·9	9·5	10·0	10·6	11·2	11·9	12·5	13·2
4	13·9	14·6	15·3	16·0	16·8	17·5	18·3	19·1	20·0	20·8
5	21·6	22·5	23·4	24·3	25·2	26·2	27·1	28·1	29·1	30·1
6	31·1	32·2	33·3	34·3	35·4	36·5	37·7	38·8	40·0	41·2
7	42·4	43·6	44·8	46·1	47·3	48·6	49·9	51·3	52·6	54·0
8	55·3	56·7	58·1	59·6	61·0	62·5	63·9	65·4	66·9	68·5
9	70·0	71·6	73·2	74·8	76·4	78·0	79·7	81·3	83·0	84·7
10	86·4	88·2	89·9	91·7	93·5	95·3	97·1	98·9	100·8	102·7
11	104·6	106·5	108·4	110·3	112·3	114·3	116·3	118·3	120·3	122·4
12	124·4	126·5	128·6	130·7	132·9	135·0	137·2	139·4	141·6	143·8
13	146·0	148·3	150·6	152·9	155·2	157·5	159·8	162·2	164·6	167·0
14	169·4	171·8	174·2	176·7	179·2	181·7	184·2	186·7	189·3	191·8
15	194·3	197·0	199·6	202·3	204·9	207·6	210·3	213	215·7	218·4
16	221·2	224	226·8	229·6	232·4	235·2	238·1	241	243·9	246·8
17	249·7	252·7	255·6	258·6	261·6	264·6	267·6	270·7	273·8	276·8
18	279·9	283	286·2	289·4	292·5	295·7	298·9	302·1	305·4	308·6
19	311·9	315·2	318·5	321·8	325·2	328·5	331·9	335·3	338·7	342·2
20	345·6	349·1	352·5	356·0	359·6	363·1	366·6	370·2	373·8	377·4
21	381	384·6	388·3	392	395·7	399·4	403·1	406·8	410·6	414·3
22	418·2	422	425·8	429·6	433·5	437·4	441·3	445·2	449·1	453
23	457	461	465	469	473·1	477·1	481·2	485·3	489·4	493·5
24	497·6	501·8	506	510·1	514·3	518·6	522·8	527·1	531·4	535·6
25	540	544·3	548·7	553	557·4	561·8	566·2	570·7	575·1	579·6
26	584	588·6	593·1	597·6	602·1	606·7	611·3	615·9	620·5	625·2
27	629·9	634·5	639·2	643·9	648·6	653·4	658·2	663	667·7	672·5
28	677·3	682·2	687	692	696·8	701·8	706·7	711·6	716·6	721·6
29	726·6	731·6	736·7	741·7	746·8	751·9	757	762·1	767·2	772·3
30	777·6	782·7	788	793·2	798·4	803·7	809	814·3	819·6	825
31	830·2	835·6	841	846·4	851·8	857·2	862·8	868·2	873·7	879·2
32	884·7	890·2	895·7	901·3	907	912·6	918·2	923·8	929·4	935·1
33	940·8	946·6	952·3	958	963·7	969·6	975·4	981·1	987	992·8
34	998·7	1005	1010·5	1016·5	1022·5	1028·5	1034·5	1040·5	1046·5	1052·5
35	1058·5	1064·5	1070·5	1076·8	1082·8	1089	1095	1101	1107·4	1113·5
36	1119·8	1125·8	1132	1138·4	1144·8	1150·8	1157·4	1163·6	1170	1176·4
37	1182·8	1189·2	1195·6	1201·9	1208·5	1215	1222·5	1228	1234·5	1240·9
38	1247·5	1254·2	1260·7	1267·3	1273·9	1280·6	1287·2	1293·8	1300·5	1307·4
39	1313·9	1320·7	1327·5	1334·3	1341	1348	1354·8	1361·7	1368·5	1375·5
40	1382·2	1389·2	1396·2	1403·4	1410	1417	1424·1	1431	1438·1	1445·2
41	1452·4	1459·5	1466·5	1473·6	1480·7	1487·9	1495	1502·3	1509·7	1516·7
42	1524	1531·2	1538·7	1545·9	1553·3	1560·4	1567·8	1575·3	1582·5	1590
43	1597·5	1604·9	1612·4	1619·8	1627·3	1634·8	1642·4	1649·8	1657·4	1664·8
44	1672·5	1680·4	1687·8	1695·4	1703·2	1710·7	1718·4	1726·2	1733·8	1741·6
45	1749·4	1757·3	1765	1772·8	1780·6	1788·6	1796·5	1804·3	1812·2	1820
46	1828	1836	1844	1852	1860	1868	1876	1884·1	1892·4	1900·4
47	1908·4	1916·7	1924·5	1933	1941	1949·4	1957·4	1965·6	1947	1982·1

TABLE No. 36.—WEIGHT OF PAPER IN KILOGRAMMES PER KILOMETRE.—*cont.*
(Specific Gravity 1·10.)

Diam. in mm.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
48	1990·5	1998·8	2007	2015·4	2023·8	2032	2041	2049	2058	2066
49	2074	2083	2091	2100	2108	2117	2126	2134	2143	2151
50	2160	2169	2177	2186	2195	2203	2212	2221	2230	2238
51	2247	2256	2265	2274	2282	2291	2300	2309	2318	2327
52	2336	2345	2354	2363	2372	2381	2390	2399	2409	2418
53	2427	2436	2445	2454	2464	2473	2482	2491	2501	2510
54	2519	2529	2538	2547	2557	2566	2575	2585	2594	2604
55	2613	2623	2632	2642	2652	2661	2671	2680	2690	2700
56	2709	2719	2729	2738	2748	2758	2768	2777	2787	2797
57	2807	2817	2827	2837	2846	2856	2866	2876	2886	2896

MULTICORE CABLES.

Prior to impregnating, the paper-insulated cores are laid up together and wormed with jute. The lay generally adopted is 20 times the pitch diameter. (*See* Chapter I., page 47.)

The diameter of a multicore cable is given in Table No. 37.

TABLE No. 37.—MULTICORE CABLES FORMED OF SIMILAR CORES OF DIAMETER d.

Number of Cores	Pitch Diameter	Overall Diameter
2	$1 \cdot 0\, d$	$2 \cdot 0\, d$
3	$1 \cdot 1547\, d$	$2 \cdot 1547\, d$
4	$1 \cdot 414\, d$	$2 \cdot 414\, d$
5	$1 \cdot 7\, d$	$2 \cdot 7\, d$
6	$2 \cdot 0\, d$	$3 \cdot 0\, d$
7	$2 \cdot 0\, d$	$3 \cdot 0\, d$

The laid-up cores are next insulated with paper, and the whole dried and impregnated. In the case of unequal cores, as for a 3-wire system, the smaller core is generally insulated with sufficient paper to bring its diameter equal to the other cores.

The specific gravity of the worming jute is 0·54, and the weight in kilogrammes per kilometre is given by $(A - a)\, 0 \cdot 54$, where A is the overall area o the laid-up cores, and a is the total area of the insulated cores; in other words, $(A - a)$ is the worming area in square millimetres.

If d represents the diameter of any one core, then the sectional area of the worming jute is given by—

2 core cables	$1 \cdot 571\, d^2$
3 "	$1 \cdot 292\, d^2$
4 "	$1 \cdot 435\, d^2$
5 "	$1 \cdot 800\, d^2$
6 "	$2 \cdot 356\, d^2$
7 "	$1 \cdot 571\, d^2$

The weight of jute worming in kilogrammes per kilometre is therefore given by—

2 core cables	$0{\cdot}85\ d^2$	d in millimetres.
3 „	$0{\cdot}70\ d^2$	
4 „	$0{\cdot}775\ d^2$	
5 „	$0{\cdot}972\ d^2$	
6 „	$1{\cdot}272\ d^2$	
7 „	$0{\cdot}85\ d^2$	

For low and medium tension cables it is sometimes economical to use sector-shaped conductors in the construction of multicore cables. The most economical sector-shape of the conductor can, however, not be used, due to the fact that the paper is cracked by the sharp angles. These angles have therefore to be rounded, and a small amount of jute packing is necessary to bring the cable up to circular form. The overall area of sector cores laid up to form a 3-core cable is equal to—

area of equivalent circular core $\times$ 3 $\times$ constant.

The value of this constant depends upon the shape of the conductor; for sector cores built up on the 6-wire basis (*see* Chapter I., page 52), its value is about $1{\cdot}155$, therefore the diameter of 3 such sector cores laid up together is equal to

$$D = d\sqrt{3 \times 1{\cdot}155} = 1{\cdot}861\ d.$$

Thus, for a 3×100 sq. mm. sector conductor cable insulated with 4 mm. of paper, copper to copper and also copper to lead sheath; the equivalent circular conductor would consist of a strand of 19 wires of diameter $2{\cdot}59$ mm., diameter of strand $= 5 \times 2{\cdot}59 = 13$ mm., diameter of insulated circular core $= 13 + 4 = 17$ mm., therefore the diameter over the three laid up sector cores would equal $17 \times 1{\cdot}861 = 31{\cdot}7$ mm., and the diameter under the lead sheath would equal $31{\cdot}7 + 4 = 35{\cdot}7$ mm.

The compounds used for the impregnation of paper cables can be divided into two groups, viz. resin oil compounds and castor oil compounds. Castor oil has the important property of retaining its greasiness at very low temperatures, and thus allows of the sliding of the paper layers on one another when the cable is bent. Resin oil, however, is much cheaper than castor oil, and at ordinary temperatures appears to equal it in useful properties. The impregnating compounds generally used are composed of some or all of the following ingredients in various proportions:—

Resin oil or castor oil.
Resin.
Yellow ceresine (cerasin).
Vaseline (petroleum jelly).
Venice turpentine.
Palm oil.

The following compounds, used by various cable manufacturers in England or on the Continent, show the percentage of the various ingredients used:—

A.—Resin oil	68 per cent.	Price $27{\cdot}0$/– per 100 kilog. or $12{\cdot}3$/– per 100 lb.	
Resin	20 „		
Ceresine	6 „		
Vaseline	6 „		
B.—Resin oil	50 per cent.	Price $20{\cdot}15$/– per 100 kilog. or $9{\cdot}16$/– per 100 lb.	
Resin	50 „		

C.—Castor oil . .	55 per cent.	Price 57·75/– per 100 kilog. or 26·2/– per 100 lb.
Resin . . .	17 „	
Ceresine . .	22 „	
Vaseline . . .	6 „	
D.—Castor oil . .	70 per cent.	Price 44·0/– per 100 kilog. or 20·0/– per 100 lb.
Resin . . .	30 „	

Generally speaking, the percentage of oil varies from 45 or 50 for low tension cables, to 70 for high tension cables.

All the ingredients should, of course, be quite free from acids.

Paper soaks up approximately 80 per cent. of its weight of impregnating compound.

Table No. 38 gives the approximate prices of various materials, which prices are, of course, liable to variation from time to time.

TABLE No. 38.—PRICES OF MATERIALS.

Material	Prices in Shillings per	
	100 kilog.	100 lb. avoir.
Manila paper .	80·0	36·30
Cellulose paper .	40·0	18·15
Castor oil . .	55·0	24·95
Resin oil . .	22·0	9·98
Yellow ceresine .	100·0	45·36
Vaseline . .	40·0	18·15
Resin . .	18·3	8·33
Venice turpentine	40·0	18·15
Palm oil . .	60·0	27·22
Jute worming .	35·0 to 37·5	15·9 to 17·0
Cotton tape .	29·7 per 100 sq. metres	25·0 per 100 sq. yards

DIELECTRIC RESISTANCE.

The dielectric resistance of paper insulated cables can be varied between very wide limits by the alteration of the composition of the impregnating compound, and also by varying the temperature of the drying operation.

Abnormally high dielectric resistance, therefore, indicates either a very hard (resinous) impregnating compound, or else a degree of charring of the paper due to drying at an excessive temperature; in either case the paper will be very liable to crack or buckle when the cable is bent.

Abnormally low dielectric resistance may indicate either insufficient drying of the paper or compound, or else a very soft (oily) impregnating compound.

In the case of low tension cables, the dielectric resistance of normal cables should be between 400 and 60 megohms per mile at 60° Fahr. (after one minute's electrification), according to the size and requirements. With increasing thickness of insulating paper, the impregnating compound must necessarily be made softer in order to allow of the cable being bent without cracking the paper; therefore, in the case of high tension cables having a dielectric thickness of even 500 mils or more, 400 to 60 megohms per mile at 60° F. is a normal value for the dielectric resistance.

The Engineering Standards Committee have issued no recommendations on the dielectric resistance of impregnated paper cables.

Table No. 39 gives the minimum dielectric resistance of various low-tension cables as recommended by the Institution of Electrical Engineers.

TABLE No. 39.—MINIMUM DIELECTRIC RESISTANCE OF IMPREGNATED PAPER INSULATED L.T. CABLES. (Recommended by the Institution of Electrical Engineers.)

Size of Conductor	Effective Area of Conductor		Megohms per Mile at 60° F.
L.S.W.G. or inch	square inch	square millimetre	minimum
up to 7/15	up to 0·028	up to 18·0	140
19/18 „ 19/·058″	0·034 „ ·05	21·8 „ 31·8	120
19/16 „ 19/15	·06 „ ·076	38·7 „ 49·0	110
19/14 „ 19/·082″	·094 „ ·0985	60·5 „ 63·5	100
37/16 „ 37/·082″	·117 „ ·192	75·3 „ 123·6	90
37/·092″ „ 61/·118″	·241 „ ·654	155·6 „ 422	80
91/·098″ „ 127/·101″	·673 „ ·998	434 „ 644	70

Temperature Coefficient.—The rate at which the dielectric resistance of impregnated paper decreases with increasing temperature varies with the composition of the impregnating compound; it also varies considerably for any given impregnating compound according to the temperature—that is to say, the dielectric resistance variation per degree of temperature is not a constant throughout the range of ordinary working temperatures.

These variations can be seen from the following figures taken from dielectric resistance/temperature curves of paper insulated cables impregnated with five standard compounds.

TABLE No. 40.—TEMPERATURE COEFFICIENTS FOR THE DIELECTRIC RESISTANCE OF IMPREGNATED PAPER CABLES.

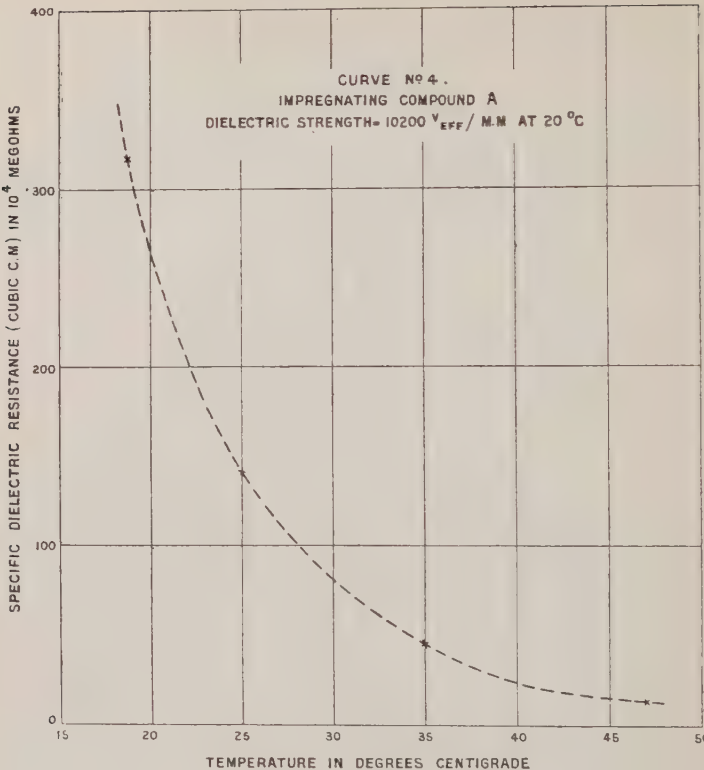
Impregnating Compound	Coefficient for 5° C. (15° C. to 20° C.) or 9° F. (60° F. to 69° F.)	Coefficient for 10° C. (15° C. to 25° C.) or 18° F. (60° to 78° F.)
A	1·620	2·680
B	1·590	2·440
C	1·940	5·000
D	1·606	2·956
E	2·460	4·910

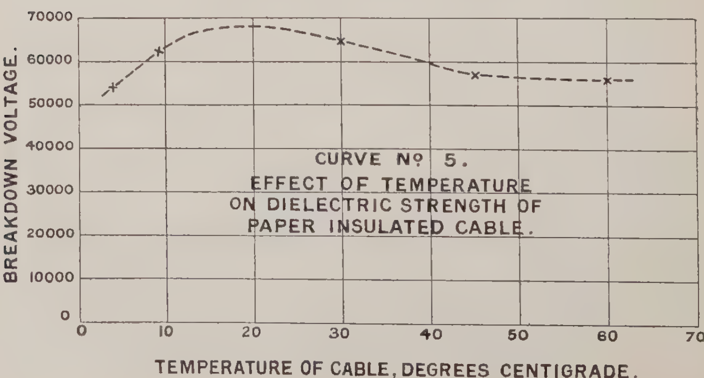
Curve No. 4 shows the specific dielectric resistance of impregnating compound A at various temperatures.

The dielectric constant (or specific inductive capacity) of unimpregnated dried paper varies between 1·8 and 2·2: of impregnated paper as used for cables between 2·8 and 3·8.

The dielectric strength of a 6 mil dried and impregnated paper averages 3500 volts, that is, 23,000 volts per millimetre. This figure varies for different impregnating cable compounds.

The average dielectric strength of an impregnated paper cable of best manu-


CURVE No 4.
IMPREGNATING COMPOUND A
DIELECTRIC STRENGTH = 10200 V EFF / M.M AT 20 °C
SPECIFIC DIELECTRIC RESISTANCE (CUBIC C.M) IN 10⁴ MEGOHMS
400
300
200
100
0
15
20
25
30
35
40
45
50
TEMPERATURE IN DEGREES CENTIGRADE


CURVE No 5.
EFFECT OF TEMPERATURE
ON DIELECTRIC STRENGTH OF
PAPER INSULATED CABLE.
BREAKDOWN VOLTAGE.
70000
60000
50000
40000
30000
20000
10000
0
10
20
30
40
50
60
70
TEMPERATURE OF CABLE, DEGREES CENTIGRADE.

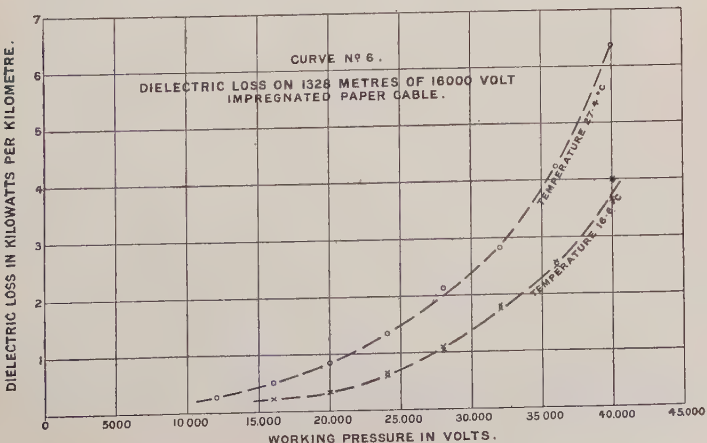
facture is 20,000 volts per millimetre. Higher dielectric strength can often be obtained, but generally by sacrificing one or more of its other essential properties. There are various "silk waste" papers which have a dielectric strength of 30,000 volts per millimetre when dried and impregnated with cable compound.

The dielectric strength of a cable varies with the temperature. To determine the amount of this variation for impregnated paper cables tests were carried out on 18 lengths of cable, each 1 yard long. The cable consisted of a conductor of 120 square millimetres cross section, insulated with 4 millimetres of paper, impregnated and lead covered. These lengths were immersed in oil at various temperatures, and when they had assumed the temperature of the oil, voltage was applied, and increased by steps of 5000 volts, at intervals of 10 seconds, until breakdown occurred.

Table No. 41 gives the results of these tests, which are also set out in Curve No. 5.

TABLE No. 41.—EFFECT OF TEMPERATURE ON DIELECTRIC STRENGTH OF IMPREGNATED PAPER CABLE.

Temperature of Cable	Breakdown Voltage	Average Value	Temperature of Cable	Breakdown Voltage	Average Value
4° C	50000		45° C.	60000	
4	55000	53300	45	55000	56600
4	55000		45	55000	
9	65000		60	55000	
9	60000	62500	60	65000	56600
9	62500		60	50000	
30	60000		75	55000	
30	70000	65000	75	50000	53300
30	65000		75	55000	



The dielectric loss in impregnated paper cables varies between 0·9 per cent. and 5 or 6 per cent. of the capacity current according to the electric stress per unit thickness of the dielectric, and according to the temperature of the dielectric. Even higher percentage loss has been observed at high temperatures, and also when the dielectric is strained by excessive voltage. The average dielectric loss at ordinary temperatures and when working with a normal factor of safety, can be taken as 1·8 per cent. of the capacity current. The effects of high temperature and excessive electric strain on the dielectric can be seen from Curve No. 6, which shows the dielectric loss on 1328 metres of 16,000 volt paper cable at temperatures 16·6° C. and 27·4° C., and with voltages up to 40,000 volts. Paper cables should on no account attain a temperature higher than 90° C.; the Institution of Electrical Engineers recommend a maximum temperature of 80° C. (176° F.).

CHAPTER III.

IMPREGNATED JUTE INSULATION.

Impregnated jute is, at present, very seldom used for insulating cables, having been almost completely supplanted by impregnated paper.

Its use is considered only in the case of small conductor multicore cables such as signal cable, pilot cable, and the test wires in paper insulated cables.

Jute Scale.—Jute yarns are measured by the yarn trade by their weight per 14,400 yards, thus 48 lb. jute weighs 48 lb. per 14,400 yards of yarn; or by the number of yards that weigh one-three-hundredth part of a pound avoirdupois, thus 48 lb. jute weighs 1 lb. per 300 yards or $\frac{1}{300}$ lb. per 1 yard, which size is known as 1 Lea jute.

The following Table No. 42 shows this yarn trade method :—

Table No. 42.—Jute Scale.

Number of Leas	A = Yards of Yarn per lb.	B = Weight of Yarn per 14,400 yards
1	300	48 lb.
2	600	24 ,,
3	900	16 ,,
6	1800	8 ,,
9·6	2880	5 ,,
16	4800	3 ,,

Basis = 14,400 yards = A × B, and A = number of Leas × 300.

Cable manufacturers, however, measure the jute by its weight in lb. avoir. per nautical mile (2029 yds.) of yarn; the relation between these two methods is shown in Table No. 43.

TABLE No. 43.—CABLE TRADE JUTE SCALE.

Cable Trade Jute Measure, *i.e.* weight per 2029 yards	Weight per 14,400 yards (Jute Trade Measure)	Number of Leas
4 oz.	1·77 lb.	27
8 „	3·55 „	13·5
16 „	7·1 „	6·8
5 lb.	35·5 „	1·35
8 „	56·8 „	0·85
10 „	71 „	·68
12 „	85 „	·56
16 „	113 „	·42
24 „	170 „	·28

Continental cable manufacturers measure jute by its weight in kilogrammes per kilometre of yarn. Table No. 44 shows the corresponding (approximate) English yarns.

TABLE No. 44.—CONTINENTAL JUTE SCALE.

Weight of Yarn per kilometre	Weight per nautical mile of Yarn	Number of Leas
0·125 kilog.	8 oz.	13·5
·25 „	16 „	6·8
·5 „	2 lb.	3·4
·75 „	3 „	2·27
1·25 „	5 „	1·35
2·0 „	8 „	0·85
2·5 „	10 „	·68

The number of yarns required to completely cover any conductor (or cylinder) depends upon the diameter of the conductor, the length of lay adopted, and the size of the yarn used. In Fig. 5 let A B represent the circumference of the conductor; draw B C perpendicular to A B, marking off B D equal to the length of lay of the yarns; join A D. Then A D gives the lay of the jute yarns on the conductor. Upon A B draw a semicircle, cutting A D at E; join B E. Then B E gives the width of the ribbon of yarns which will just cover the conductor of circumference A B with a length of lay equal to B D.

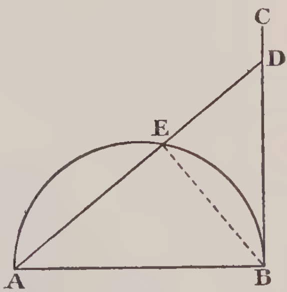


FIG. 5.

Curve No. 7 shows the method of determining the width of the necessary ribbon of jute yarns to completely cover any conductor; the number of jute yarns necessary is given by Table No. 45, which shows the number of yarns of various size which form a ribbon 1 in. in width. This table also gives the increase of diameter due to one layer of the various yarns.

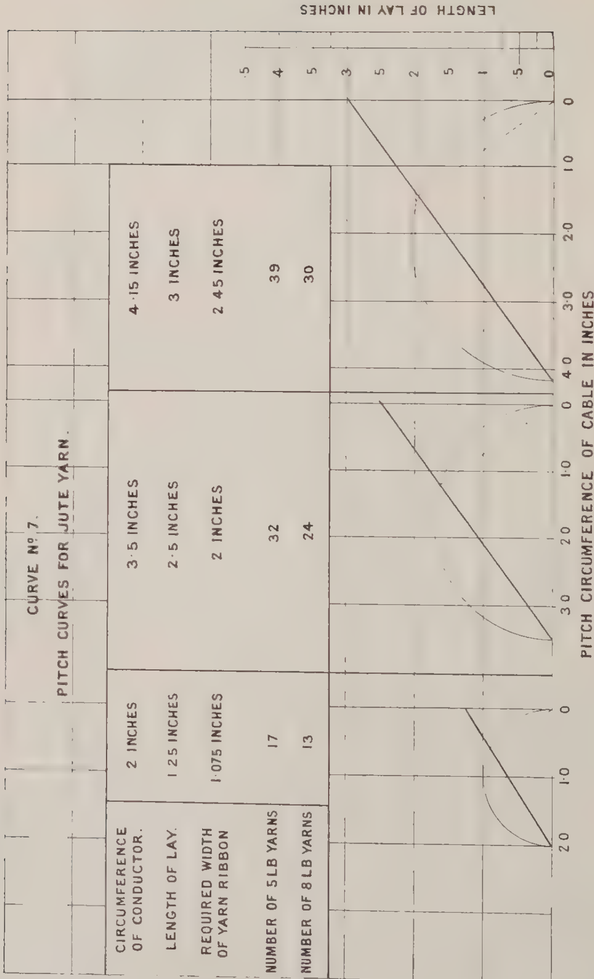

CURVE No. 7.
PITCH CURVES FOR JUTE YARN.
CIRCUMFERENCE OF CONDUCTOR. 2 INCHES 3·5 INCHES 4·15 INCHES
LENGTH OF LAY. 1·25 INCHES 2·5 INCHES 3 INCHES
REQUIRED WIDTH OF YARN RIBBON 1·075 INCHES 2 INCHES 2·45 INCHES
NUMBER OF 5 LB YARNS 17 32 39
NUMBER OF 8 LB YARNS 13 24 30
LENGTH OF LAY IN INCHES
PITCH CIRCUMFERENCE OF CABLE IN INCHES

TABLE No. 45.—THICKNESS OF JUTE YARNS.

Size of Yarn		Number of Yarns to form a ribbon one inch wide	Increase of Diameter for one layer		Increase of Radial Thickness for one layer	
lb. per Nautical Mile	Kilogrammes per Kilometre		mils	mm.	mils	mm.
½	0·125	..	20	0·5	10	0·25
1	·25	..	30	·75	15	·375
2	·5	..	40	1·0	20	·5
3	·75	..	60	1·5	30	·75
5	1·25	16	79	2·0	39·5	1·0
6	1·5	14	87	2·2	43·5	1·1
7	1·75	13	95	2·4	47·5	1·2
8	2·0	12	102	2·6	51	1·3
9	2·25	11	110	2·8	55	1·4
10	2·5	11	118	3·0	59	1·5
11	2·7	10	126	3·2	63	1·6
12	2·9	10	134	3·4	67	1·7
13	3·17	..	142	3·6	71	1·8
14	3·4	..	150	3·8	75	1·9
15	3·75	..	158	4·0	79	2·0
16	3·9	..	165	4·2	82·5	2·1
17	4·15	..	173	4·4	86·5	2·2

The layers of jute yarn are applied to the conductor with a right and left-handed lay alternately. When insulated to the requisite thickness the cable is dried and impregnated.

By the older method the cable is subjected to a temperature of about 270° F. (133° C.) in a steam-coil chest, or pan, for 70 to 100 hours; this method is very slow, and the jute becomes more or less perished. By the new (comparatively) method the cable is subjected to a temperature of about 230° F. (110° C.) in a steam-coil vacuum chamber for from 16 to 36 hours.

The cable, after drying, is impregnated with compound for from 2 hours to even 24 hours in the case of concentric conductor cables, according to the thickness of jute insulation and the nature of the impregnating compound. The cable is next lead or bitumen sheathed, as required.

Table No. 46 gives the thickness of jute for low tension cables as recommended by the Engineering Standards Committee; for high tension cables this body consider only paper and rubber insulation.

Table No. 47 shows the thickness of jute insulation for low tension cables as recommended by the Institution of Electrical Engineers.

Table No. 48 shows the thickness of jute insulation for low tension cables as recommended by the Verband Deutscher Elektrotechniker; for high tension cables the thickness is left to the cable manufacturer to decide.

TABLE NO. 46.—THICKNESS OF JUTE INSULATION FOR CABLES UP TO 660 VOLTS PRESSURE. (As recommended by the Engineering Standards Committee.)

Section of Conductor		Single Cables		Concentric Cables (over each Conductor)		Triple Concentric Cables (over each Conductor)		Twin and 3-Core (between Conductors and between any Conductor and Lead)	
sq. inch	sq. mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
0·025	16·13	80	2·03	80	2·03	80	2·03	90	2·29
·050	32·26	80	2·03	80	2·03	80	2·03	90	2·29
·075	48·4	80	2·03	80	2·03	80	2·03	90	2·29
·100	64·5	90	2·29	90	2·29	90	2·29	100	2·54
·125	80·6	90	2·29	90	2·29	90	2·29	100	2·54
·15	96·8	90	2·29	90	2·29	90	2·29	100	2·54
·20	129	90	2·29	90	2·29	90	2·29	100	2·54
·25	161	100	2·54	100	2·54	100	2·54	110	2·79
·30	193	100	2·54	100	2·54	100	2·54	110	2·79
·35	226	100	2·54	100	2·54	100	2·54	110	2·79
·40	258	100	2·54	100	2·54	100	2·54	110	2·79
·50	322	100	2·54	100	2·54	100	2·54	110	2·79
·60	387	110	2·79	110	2·79	..	..	..	..
·70	451	110	2·79	110	2·79	..	..	..	..
·75	484	110	2·79	110	2·79	..	..	..	..
·80	516	120	3·05	120	3·05	..	..	..	..
·90	581	120	3·05	120	3·05	..	..	..	..
1·00	645	130	3·30	130	3·30	..	..	..	..

TABLE NO. 47.—THICKNESS OF JUTE INSULATION FOR LOW TENSION CABLES. (As recommended by the Institution of Electrical Engineers.)

Conductor L.S.W.G. or inch	Conductor Section		Jute Thickness		Conductor L.S.W.G. or inch	Conductor Section		Jute Thickness	
	sq. inch	sq. mm.	mils	mm.		sq. inch	sq. mm.	mils	mm.
7/18	0·012456	8·036	80	2·03	19/·101″	0·14939	96·378	90	2·29
7/17	·016949	10·935	80	2·03	37/14	·18242	117·69	90	2·29
19/20	·018979	12·244	80	2·03	37/·082″	·19166	123·65	90	2·29
7/16	·022138	14·283	80	2·03	37/·092″	·24126	155·65	100	2·54
19/19	·023431	15·117	80	2·03	37/·101″	·29077	187·59	100	2·54
7/·068″	·024992	16·124	80	2·03	37/·110″	·34490	222·51	100	2·54
7/15	·028019	18·076	80	2·03	61/13	·39767	256·56	100	2·54
19/18	·033740	21·768	80	2·03	61/·098″	·45123	291·12	100	2·54

Table No. 47.—Thickness of Jute insulation for Low Tension Cables. (As recommended by the Institution of Electrical Engineers.)—*continued.*

Conductor L.S.W.G. or inch	Conductor Section sq. inch	Conductor Section sq. mm.	Jute Thickness mils	Jute Thickness mm.	Conductor L.S.W.G. or inch	Conductor Section sq. inch	Conductor Section sq. mm.	Jute Thickness mils	Jute Thickness mm.
7/14	0·034591	22·317	80	2·03	61/·101″	0·47928	309·21	100	2·54
19/17	·045925	29·629	80	2·03	61/·108″	·54802	353·56	110	2·79
7/·095″	·048778	31·470	80	2·03	61/·110″	·57341	369·94	110	2·79
19/·058″	·049623	31·783	80	2·03	61/·118″	·65420	422·06	110	2·79
19/16	·059983	38·699	80	2·03	91/·098″	·67308	434·25	110	2·79
19/15	·075916	48·978	80	2·03	91/·101″	·71492	461·24	110	2·79
19/14	·093724	60·467	90	2·29	91/12	·75802	489·05	120	3·05
19/·082″	·098468	63·528	90	2·29	91/·110″	·84801	547·10	120	3·05
37/16	·11675	75·324	90	2·29	91/·118″	·97584	629·58	130	3·30
19/13	·12395	79·967	90	2·29	127/·101″	·99765	643·68	130	3·30
37/15	·14776	95·332	90	2·29					

Table No. 48.—Thickness of Jute Insulation for Cables up to 700 Volts Pressure. (As recommended by the Verband Deutscher Elektrotechniker.)

Section of Conductor sq. mm.	Section of Conductor sq. inch	Single Cables mm.	Single Cables mils	Concentric and Multicore mm.	Concentric and Multicore mils
1·0	0·00155	1·75	69	2·3	90·7
1·5	·00232	1·75	69	2·3	90·7
2·5	·00387	1·75	69	2·3	90·7
4·0	·0062	1·75	69	2·3	90·7
6	·0093	1·75	69	2·3	90·7
10	·0155	1·75	69	2·3	90·7
16	·0248	2·00	79	2·3	90·7
25	·0387	2·00	79	2·3	90·7
35	·0542	2·00	79	2·3	90·7
50	·0775	2·00	79	2·3	90·7
70	·1085	2·00	79	2·3	90·7
95	·147	2·00	79	2·3	90·7
120	·186	2·00	79	2·3	90·7
150	·232	2·25	88·5	2·3	90·7
185	·286	2·25	88·5	2·5	98·5
240	·372	2·50	98·5	2·5	98·5
310	·480	2·50	98·5	2·8	110
400	·620	2·50	98·5	2·8	110
500	·775	2·75	108	..	..
625	·968	2·75	108	..	..
800	1·240	3·00	118	..	.
1000	1·550	3·00	118	..	..

Table No. 49 gives the thickness of jute insulation generally adopted by Continental cable manufacturers.

TABLE No. 49.—THICKNESS OF JUTE INSULATION IN MILLIMETRES. (Continental Practice.)

Type of Cable	Working Pressure in Volts				
	Up to 500	700	1000	2000	3000
Single . . .	1·1 to 1·5	1·65 to 2·0	2·0 to 2·5	2·5 to 3·0	3·0
Twin . . .	1·5 „ 1·8	2·0 „ 2·3	2·0 „ 2·5	3·0	4·0
Three core . .	1·5 „ 1·8	2·0 „ 2·3	2·0 „ 2·5	3·0	4·0
Concentric . .	2·3	2·5	3·0	5·0	6·25
Triple concentric .	2·3	2·5	3·0	5·0	6·25

Jute yarn under lead sheathing has, owing to compression, a specific gravity of 0·875; therefore, if the under and over diameters of any layer or layers be d and D millimetres respectively, the weight of the jute can be calculated from the following formulæ—

weight in kilogrammes per kilometre $= 0·687\ (D^2 - d^2)$;
weight in lb. per 1000 yards $= 1·385\ (D^2 - d^2)$;
weight in lb. per statute mile $= 2·438\ (D^2 - d^2)$.

There are two classes of impregnating compounds used for jute cables:—

(i) Ceresine compound, consisting of approximately equal weights of ceresine and Venice turpentine, with which the cables are impregnated for from 2 to 5 hours at a temperature of about 230° F. (110° C.).

(ii) Asphaltum compound, consisting of varying proportions of asphaltum and resin oil: the compounds average 70–80 per cent. of asphaltum to 30–20 per cent. of resin oil; the cables are impregnated for from 2 to 24 hours at a temperature of about 230° F. (110° C.).

Jute yarns soak up approximately 80 per cent. of their weight of impregnating compound.

Table No. 50 gives the approximate prices of the various materials, which prices are, of course, liable to variation from time to time.

TABLE No. 50.—PRICES OF MATERIALS.

Material	Price in Shillings per	
	100 kg.	100 lb.
Ceresine	100	45·36
Venice turpentine	40	18·15
Asphaltum	28	12·70
Resin oil	22	9·98
Insulating jute, best quality . . .	43 to 45	19·5 to 20·4
„ „ second quality . .	40 to 42	18·15 to 19·1
Worming jute	35 to 37·5	15·9 to 17·0

Dielectric Resistance.—The dielectric resistance of impregnated jute cable varies with the composition of the impregnating compound, and also with the time and temperature of the drying operation. The average value is about 30×10^8 megohms per cubic centimetre at 15° C. after one minute's electrification.

Table No. 51 gives the minimum dielectric resistance of cables insulated with various thicknesses of jute yarn, and impregnated with a standard compound.

TABLE No. 51.—DIELECTRIC RESISTANCE OF IMPREGNATED JUTE CABLES, IN MEGOHMS PER KILOMETRE AT 15° C. AFTER ONE MINUTE'S ELECTRIFICATION.

Section of Conductor		Thickness of Dielectric in Millimetres										
mm.²	sq. inch	1·00	1·25	1·50	1·75	2·00	2·25	2·50	2·75	3·00	4·00	5·00
4	0·0062	3450	4030	4580	4980	5530	5950	6340	6700	7050	8210	9170
6	·0093	2960	3510	3990	4440	4870	5250	5620	5950	6270	7400	8300
10	·0155	2180	2630	3010	3390	3740	4050	4370	4670	5180	5920	6750
16	·0248	1800	2170	2510	2840	3130	3430	3700	3970	4210	5100	5870
25	·0387	1380	1670	1960	2240	2480	2720	2980	3180	3400	4180	4850
35	·0542	1220	1500	1750	2000	2220	2450	2660	2880	3070	3800	4440
50	·0775	1050	1300	1510	1710	1925	2120	2310	2500	2680	3340	3930
70	·1085	900	1100	1290	1460	1660	1820	2000	2170	2330	2930	3460
95	·147	785	960	1130	1300	1460	1610	1760	1920	2060	2610	3080
120	·186	700	860	1020	1180	1320	1460	1600	1740	1880	2380	2840
150	·232	630	770	915	1050	1190	1320	1460	1590	1710	2160	2580
185	·286	565	685	820	945	1060	1180	1300	1410	1520	1950	2340
210	·325	535	655	775	900	1015	1090	1230	1350	1450	1865	2250
240	·372	500	625	740	850	960	1080	1180	1300	1390	1780	2140
280	·434	470	585	690	800	900	1025	1105	1210	1300	1680	2030
310	·480	445	555	665	770	865	965	1060	1160	1250	1610	1940
355	·550	415	515	615	710	810	900	995	1080	1170	1510	1830
400	·620	400	495	585	675	765	860	945	1035	1110	1440	1750
500	·775	360	440	535	605	690	770	850	930	1000	1300	1580
625	·968	320	400	470	540	620	690	770	840	910	1180	1440
725	1·123	300	380	450	515	585	655	725	795	855	1110	1350
800	1·240	280	350	415	480	550	615	675	740	810	1050	1280
1000	1·550	255	275	380	445	500	560	625	675	735	960	1175

Temperature Coefficient.—The rate at which the dielectric resistance decreases with increasing temperature varies with the composition of the impregnating compound. Tables Nos. 52 and 53 show the coefficients for two standard classes of cables.

TABLE No. 52.—TEMPERATURE COEFFICIENTS FOR IMPREGNATED JUTE CABLES.

The dielectric resistance at 15° C. is equal to the D.R. at $t°$ C. multiplied by the coefficient for $t°$ C.

$t°$ C.	Coefficient	$t°$ C.	Coefficient	$t°$ C.	Coefficient	$t°$ C.	Coefficient
0·0	0·0639	10·5	0·409	21·0	2·90	31·5	10·9
0·5	·0672	11·0	·453	21·5	3·11	32·0	11·3
1·0	·0709	11·5	·500	22·0	3·38	32·5	11·7
1·5	·0748	12·0	·553	22·5	3·58	33·0	11·9
2·0	·0794	12·5	·614	23·0	3·80	33·5	12·2
2·5	·0845	13·0	·675	23·5	4·10	34·0	12·4
3·0	·0901	13·5	·744	24·0	4·35	34·5	12·7
3·5	·0965	14·0	·821	24·5	4·54	35·0	12·9
4·0	·1030	14·5	·907	25·0	4·91	35·5	13·2
4·5	·1130	15·0	1·000	25·5	5·25	36·0	13·5
5·0	·1230	15·5	1·10	26·0	5·53	36·5	13·8
5·5	·136	16·0	1·22	26·5	5·96	37·0	14·2
6·0	·152	16·5	1·34	27·0	6·34	37·5	14·5
6·5	·172	17·0	1·46	27·5	6·91	38·0	14·8
7·0	·194	17·5	1·60	28·0	7·60	38·5	15·2
7·5	·219	18·0	1·76	28·5	8·00	39·0	16·0
8·0	·244	18·5	1·90	29·0	8·69	39·5	17·4
8·5	·273	19·0	2·07	29·5	9·50	40·0	19·0
9·0	·303	19·5	2·26	30·0	9·81	..	..
9·5	·336	20·0	2·46	30·5	10·1	..	..
10·0	·370	20·5	2·65	31·0	10·5	..	..

The dielectric constant (specific inductive capacity) of impregnated jute varies between 3 and 4.

The dielectric strength of impregnated jute varies between 4000 and 7000 volts per millimetre.

The dielectric loss in impregnated jute cables averages 2–3 per cent. of the capacity current, according to working temperature and the electric stress upon the dielectric.

TABLE NO. 53.—TEMPERATURE COEFFICIENTS FOR IMPREGNATED JUTE CABLES.

The dielectric resistance at 60° F. is equal to the D.R. at $t°$ F. divided by the coefficient for $t°$ F.

$t°$ F.	Coefficient	$t°$ F.	Coefficient	$t°$ F.	Coefficient	$t°$ F.	Coefficient
25·0	19·77	38·0	6·526	51·0	2·154	64·0	0·7110
25·5	18·95	38·5	6·254	51·5	2·064	64·5	·6813
26·0	18·16	39·0	5·993	52·0	1·979	65·0	·6529
26·5	17·40	39·5	5·743	52·5	1·895	65·5	·6257
27·0	16·67	40·0	5·503	53·0	1·816	66·0	·5995
27·5	15·98	40·5	5·273	53·5	1·741	66·5	·5745
28·0	15·31	41·0	5·053	54·0	1·668	67·0	·5505
28·5	14·67	41·5	4·842	54·5	1·598	67·5	·5275
29·0	14·06	42·0	4·640	55·0	1·532	68·0	·5055
29·5	13·47	42·5	4·446	55·5	1·468	68·5	·4845
30·0	12·91	43·0	4·261	56·0	1·406	69·0	·4642
30·5	12·37	43·5	4·083	56·5	1·348	69·5	·4449
31·0	11·85	44·0	3·913	57·0	1·291	70·0	·4263
31·5	11·36	44·5	3·749	57·5	1·238	70·5	·4085
32·0	10·89	45·0	3·593	58·0	1·186	71·0	·3914
32·5	10·43	45·5	3·443	58·5	1·136	71·5	·3751
33·0	9·996	46·0	3·299	59·0	1·089	72·0	·3594
33·5	9·578	46·5	3·162	59·5	1·044	72·5	·3445
34·0	9·179	47·0	3·030	60·0	1·0000	73·0	·3301
34·5	8·795	47·5	2·902	60·5	0·9583	73·5	·3163
35·0	8·428	48·0	2·782	61·0	·9183	74·0	·3031
35·5	8·077	48·5	2·666	61·5	·8800	74·5	·2904
36·0	7·740	49·0	2·555	62·0	·8432	75·0	·2783
36·5	7·416	49·5	2·448	62·5	·8080	..	..
37·0	7·107	50·0	2·346	63·0	·7743	..	..
37·5	6·810	50·5	2·248	63·5	·7420	..	..

CHAPTER IV.

INDIARUBBER AND GUTTA-PERCHA.

(A) Indiarubber.

THE species of rubber used for insulating electric conductors are chiefly: Para, Plantation Para, Mozambique, Accra Strip, Para Negroheads, Mollendo, Congo, Cameta Head, Gold Coast, Singapore, Santos Sheet, etc.

For the manufacture of cable, the raw rubber is cut up into small pieces, soaked in hot water, and then masticated in rollers under a stream of water in order to separate and wash out the impurities. Table No. 54 shows the average loss in weight by washing, and also the relative price of raw and cleaned rubber; these figures are of course approximate, and vary from time to time.

After the masticating process, the rubber sheets are dried either by being hung in steam-heated rooms for several weeks, or by being hung in shafts in a current of dry air, or by the more modern process—a few hours in a suitable vacuum heating cupboard.

When thoroughly dry, the rubber is worked up again in the mixing rollers, and the mineral ingredients added and thoroughly mixed in. The rubber batch is next calendered into a sheet of the required thickness, and finally cut into strips ready for the rubber-covering machine.

TABLE No. 54.—INDIARUBBER.

Rubber Species	Loss in Washing	Relative Price	
		Raw	Cleaned, exclusive of Wages
Para	17	100	120·5
Plantation sheet	1	92·3	93·3
Plantation crêpé	1	80·8	81·6
Para negroheads	31	63·2	91·6
Cameta	27	80·8	110·7
Mozambique spindles	28	61·9	86·0
Accra strip	24	65·8	86·6
Borneo	40	52·6	87·7
Common Borneo	53	28·9	61·5
Mozambique ball	20	71·0	88·8

The chief ingredients mixed with the rubber to form the rubber compounds are: zinc oxide, French chalk, whiting, zinc white, magnesia, prepared lime, ceresine, litharge, plaster of Paris, and sulphur.

There are three standard methods of applying the rubber to the conductor:—

(1) *Lapping.*—The conductor is spirally lapped with the rubber in the form of a ribbon. The first layer generally consists of pure rubber; the separator rubber is next applied, and finally the jacket rubber. The rubber-covered conductor is next lapped with indiarubber-saturated tape and then vulcanised. This method of covering is generally only adopted in the case of large cable.

(2) *Longitudinally Covering.*—This method is universally used for covering ordinary size conductors, one machine applying the pure, separator and jacket rubbers in one operation. The conductor or conductors are fed through rollers between two ribbons of rubber, semicircular grooves in each roller forcing the rubber round the conductors and cutting off the excess rubber, the pressure at the joint being sufficient to make the freshly-cut rubber to adhere, thus forming a circular tube of rubber round the conductor. In the case of the small-size cable, one three-headed longitudinal machine can apply the three rubber coats to as many as 24 conductors in one operation. Some engineers specify that the pure rubber shall be spirally lapped on to the conductor, and not longitudinally applied. The rubber-covered core is next lapped with india-rubber coated tape, and finally the whole vulcanised together.

(3) *Forcing.*—This method is extensively used on the Continent and in America for insulating the lower qualities of cable. The tinned conductor is passed through a forcing machine, which, by means of a worm wheel, forces the rubber through a die around the conductor. The core is coiled direct into chalk pans and vulcanised, the layer of tape, if needed, being applied after vulcanisation.

Vulcanisation is generally effected by coiling the rubber-covered core on to an iron drum, which is placed inside a steam-jacketed vulcaniser. The steam pressure in the vulcaniser should not, generally speaking, exceed 40 lb., nor should the time of vulcanising greatly exceed $1\frac{1}{2}$ hours. Of course, no hard and fast rule can be given for the pressure and time, but extensive tests (given later) show that the above given values should only be exceeded in exceptional cases. It must also be remembered that although over-vulcanised rubber has a very high dielectric resistance (electric) its mechanical properties are poor and its durability is considerably diminished as oxidisation of the rubber may follow in a comparatively short time.

Table No. 55 gives the thickness of rubber insulation for internal wiring cables, as recommended by the Engineering Standards Committee.

Table No. 56 gives the thickness of rubber insulation for various cables also recommended by the E.S.C.

TABLE No. 55.—THICKNESS OF RUBBER. (As recommended by the Engineering Standards Committee for internal wiring cables.)

Conductor L.S.W.G. or inch	Effective Area		Min. Thickness		Conductor L.S.W.G. or inch	Effective Area		Min. Thickness	
	sq. in.	sq. mm.	mils	mm.		sq. in.	sq. mm.	mils	mm.
1/18	0·001809	1·1675	35	0·889	19/18	0·033740	21·768	54	1·372
3/22	·001811	1·1684	36	·914	7/14	·034591	22·317	54	1·372
1/17	·002463	1·5890	36	·914	7/·095″	·048778	31·470	59	1·499
3/20	·002994	1·9314	38	·965	19/·058″	·049623	31·783	59	1·499
1/16	·003217	2·0755	36	·914	19/16	·059983	38·699	62	1·575
1/15	·004071	2·6267	37	·940	19/14	·093724	60·467	70	1·778
7/22	·004237	2·7338	39	·991	19/·082″	·098468	63·528	71	1·803
1/14	·005026	3·2429	38	·965	37/16	·11675	75·324	75	1·905
3/18	·005322	3·4337	40	1·016	19/·092″	·12395	79·967	76	1·930
7/20	·007005	4·5191	41	1·041	19/·101″	·14939	96·378	81	2·057
7/18	·012456	8·036	44	1·118	37/15	·14776	95·332	80	2·032
19/20	·018979	12·244	48	1·219	19/12	·15839	102·19	82	2·083
7/16	·022138	14·283	49	1·245	37/14	·18242	117·69	86	2·184

TABLE No. 56.—THICKNESS OF RUBBER INSULATION.

Section of Conductor		Single Cables for Pressure of										Concentric			
		660 volts		2200 volts		3300 volts		6600 volts		11,000 volts		660 volts		2200 volts	
sq. inch	sq. mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
0·025	16·13	62	1·57	110	2·79	130	3·30	200	5·08	290	7·37	62	1·57	110 70	2·79 1·78
·050	32·26	62	1·57	110	2·79	130	3·30	200	5·08	290	7·37	62	1·57	110 70	2·79 1·78
·075	48·4	66	1·68	120	3·05	140	3·56	210	5·33	300	7·62	66	1·68	120 80	3·05 2·03
·100	64·5	71	1·80	120	3·05	140	3·56	210	5·33	300	7·62	71	1·80	120 80	3·05 2·03
·125	80·6	76	1·93	120	3·05	140	3·56	210	5·33	300	7·62	76	1·93	120 80	3·05 2·03
·15	96·8	80	2·03	130	3·30	150	3·81	220	5·59	310	7·87	80	2·03	130 90	3·30 2·29
·20	129	87	2·21	130	3·30	150	3·81	220	5·59	310	7·87	87	2·21	130 90	3·30 2·29
·25	161	94	2·39	130	3·30	150	3·81	220	5·59	310	7·87	94	2·39	130 90	3·30 2·29
·30	193	101	2·56	..	..	..	..	..	..	..	..	101	2·56	..	..
·35	226	107	2·72	..	..	..	..	..	..	..	..	107	2·72	..	..
·40	258	113	2·87	..	..	..	..	..	..	..	..	113	2·87	..	..
·50	322	121	3·07	..	..	..	..	..	..	..	..	121	3·07	..	..
·60	387	125	3·17	..	..	..	..	..	..	..	..	125	3·17	..	..
·70	451	129	3·28	..	..	..	..	..	..	..	..	129	3·28	..	..
·75	484	131	3·33	..	..	..	..	..	..	..	..	131	3·33	..	..
·80	516	133	3·38	..	..	..	..	..	..	..	..	133	3·38	..	..
·90	581	137	3·48	..	..	..	..	..	..	..	..	137	3·48	..	..
1·00	645	141	3·58	..	..	..	..	..	..	..	..	141	3·58	..	..

In the case of concentric cables having the outer earthed, a reduction can be as e.g. 130/80 mils, which means that for unearthed working the inner and outer shall have a thickness of 130 mils and the outer dielectric a thickness of 80 mils.

(As recommended by the Engineering Standards Committee.)

Cables for Pressure of						Three-Core Cables for Pressure of									
3300 volts		6600 volts		11,000 volts		660 volts		2200 volts		3300 volts		6600 volts		11,000 volts	
mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
130 80	3·30 2·03	200 90	5·08 2·29	290 100	7·37 2·54	62	1·57	110	2·79	130	3·30	200	5·08	290	7·37
130 80	3·30 2·03	200 90	5·08 2·29	290 100	7·37 2·54	62	1·57	110	2·79	130	3·30	200	5·08	290	7·37
140 90	3·56 2·29	210 100	5·33 2·54	300 110	7·62 2·79	66	1·68	120	3·05	140	3·56	210	5·33	300	7·62
140 90	3·56 2·29	210 100	5·33 2·54	300 110	7·62 2·79	71	1·80	120	3·05	140	3·56	210	5·33	300	7·62
140 90	3·56 2·29	210 100	5·33 2·54	300 110	7·62 2·79	76	1·93	120	3·05	140	3·56	210	5·33	300	7·62
150 100	3·81 2·54	220 110	5·59 2·79	310 120	7·87 3·05	80	2·03	130	3·30	150	3·81	220	5·59	310	7·87
150 100	3·81 2·54	220 110	5·59 2·79	310 120	7·87 3·05	87	2·21	130	3·30	150	3·81	220	5·59	310	7·87
150 100	3·81 2·54	220 110	5·59 2·79	310 120	7·87 3·05	94	2·39	130	3·30	150	3·81	220	5·59	310	7·87
..	..	..	..	..	..	101	2·56	..	..	..	..	..	..	..	..
..	..	..	..	..	..	107	2·72	..	..	..	..	..	..	..	..
..	..	..	..	..	..	113	2·87	..	..	..	..	..	..	..	..
..	..	..	..	..	..	121	3·07	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

made in the thickness of the outer dielectric; this is shown in the above table, thickness shall be 130 mils each, but for earthed working the inner dielectric

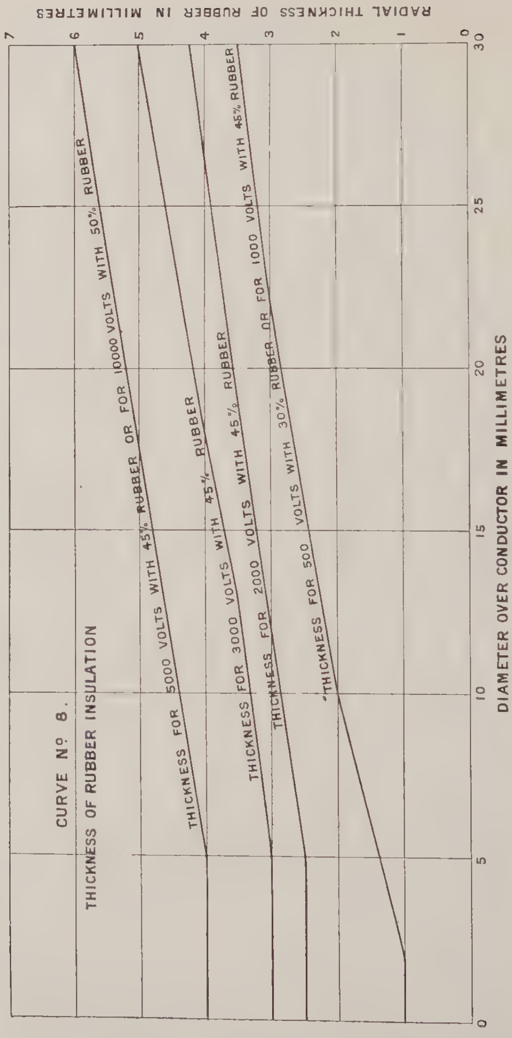

RADIAL THICKNESS OF RUBBER IN MILLIMETRES
0 1 2 3 4 5 6 7
CURVE Nº 8.
THICKNESS OF RUBBER INSULATION
THICKNESS FOR 5000 VOLTS WITH 45% RUBBER OR FOR 10000 VOLTS WITH 50% RUBBER
THICKNESS FOR 3000 VOLTS WITH 45% RUBBER
THICKNESS FOR 2000 VOLTS WITH 45% RUBBER
THICKNESS FOR 500 VOLTS WITH 30% RUBBER OR FOR 1000 VOLTS WITH 45% RUBBER
0 5 10 15 20 25 30
DIAMETER OVER CONDUCTOR IN MILLIMETRES

Table No. 57 gives the thickness of rubber insulation for various cables as recommended by the Institution of Electrical Engineers.

Table No. 58 gives the thickness of rubber insulation for cables up to 1000 volts working pressure, as recommended by the Verband Deutscher Elektrotechniker.

Table No. 59 gives the thickness of pure and vulcanised rubber for ordinary low tension cables according to the average English practice, the tendency at present, however, being to increase the thickness of pure rubber very considerably (from 50 to 100 per cent.).

Curve No. 8 gives the thickness of rubber insulation usually adopted by Continental manufacturers.

TABLE No. 57.—THICKNESS OF RUBBER INSULATION. (Recommended by the Institution of Electrical Engineers.)

Size of Conductor L.S.W.G. or inches	Effective Area of Conductor		Up to 250 Volts			Up to 650 Volts		
			Minimum thickness		Minimum Insulation in Megohms per mile 60° F.	Minimum thickness		Minimum Insulation in Megohms per mile 60° F.
	Square inch	Square millimetre	mils	mm.		mils	mm.	
3/25	0·000924	0·5961	34	0·86	2000	62	1·57	5000
3/24	·001115	·7196	34	·86	2000	62	1·57	5000
3/23	·001330	·8584	35	·89	2000	62	1·57	5000
1/18	·001809	1·1674	35	·89	2000	62	1·57	5000
3/22	·001811	1·1684	36	·91	2000	62	1·57	5000
7/25	·002162	1·3948	36	·91	2000	62	1·57	5000
3/21	·002365	1·5260	38	·96	2000	62	1·57	5000
1/17	·002463	1·5890	36	·91	2000	62	1·57	5000
7/24	·002610	1·6838	37	·94	2000	62	1·57	5000
3/20	·002994	1·9314	38	·96	2000	62	1·57	5000
7/23	·003113	2·0085	37	·94	2000	62	1·57	5000
1/16	·00322	2·075	36	·91	2000	62	1·57	5000
3/19	·00369	2·384	39	·99	1250	62	1·57	4500
1/15	·00407	2·627	37	·94	1250	62	1·57	4500
7/22	·00424	2·734	39	·99	1250	62	1·57	4500
1/14	·00503	3·243	38	·96	1250	62	1·57	4500
3/18	·00532	3·434	40	1·02	1250	62	1·57	4500
7/21	·00553	3·571	40	1·02	1250	62	1·57	4500
7/20	·00700	4·519	41	1·04	900	62	1·57	4000
7/19	·00865	5·579	42	1·07	900	62	1·57	4000
7/18	·0124	8·036	44	1·12	900	62	1·57	4000
7/17	·0169	10·93	47	1·19	900	62	1·57	4000
19/20	·0190	12·24	48	1·22	900	62	1·57	3500
7/16	·0221	14·28	49	1·24	900	62	1·57	3500
19/19	·0234	15·12	50	1·27	750	62	1·57	3500
7/·068″	·0250	16·12	51	1·30	750	62	1·57	3500
7/15	·0280	18·07	52	1·32	750	62	1·57	3500
19/18	·0337	21·77	54	1·37	750	62	1·57	3000
7/14	·0346	22·32	54	1·37	750	62	1·57	3000

TABLE No. 57.—THICKNESS OF RUBBER INSULATION—*continued.*
(Recommended by the Institution of Electrical Engineers.)

Size of Conductor L.S.W.G. or inches	Effective Area of Conductor		Up to 250 Volts			Up to 650 Volts		
	Square inch	Square millimetre	Minimum thickness mils	Minimum thickness mm.	Minimum Insulation in Megohms per mile 60° F.	Minimum thickness mils	Minimum thickness mm.	Minimum Insulation in Megohms per mile 60° F.
19/17	0·0459	29·63	58	1·47	750	62	1·57	3000
7/·095″	·0488	31·47	59	1·50	750	62	1·57	3000
19/·058″	·0496	31·78	59	1·50	750	62	1·57	3000
19/16	·0600	38·70	62	1·57	750	66	1·68	3000
19/15	·0759	48·98	66	1·68	600	66	1·68	3000
19/14	·0937	60·47	71	1·80	600	71	1·80	3000
19/·082″	·0985	63·53	71	1·80	600	71	1·80	3000
37/16	·1167	75·32	76	1·93	600	76	1·93	3000
19/13	·1239	79·97	76	1·93	600	76	1·93	3000
37/15	·1478	95·33	80	2·03	600	80	2·03	3000
19/·101″	·1494	96·38	80	2·03	600	80	2·03	3000
37/14	·1824	117·7	87	2·21	600	87	2·21	2500
37/·082″	·1916	123·6	87	2·21	600	87	2·21	2500
37/·092″	·2413	155·6	94	2·39	600	94	2·39	2500
37/·101″	·2907	187·6	101	2·56	600	101	2·56	2500
37/·110″	·3449	222·5	107	2·72	600	107	2·72	2500
61/13	·3977	256·6	113	2·87	600	113	2·87	2500
61/·098″	·4512	291·1	121	3·07	600	121	3·07	2500
61/·101″	·4793	309·2	121	3·07	600	121	3·07	2500
61/·108″	·5480	353·6	125	3·17	600	125	3·17	2500
61/·110″	·5734	369·9	125	3·17	600	125	3·17	2500
61/·118″	·6542	422·1	129	3·28	600	129	3·28	2500
91/·098″	·6730	434·2	129	3·28	600	129	3·28	2500
91/·101″	·7149	461·2	133	3·38	600	133	3·38	2500
91/12	·7580	489·0	133	3·38	600	133	3·38	2500
91/·110″	·8480	547·1	137	3·48	600	137	3·48	2500
91/·118″	·9758	629·6	141	3·58	600	141	3·58	2500
127/·101″	·9976	643·7	141	3·58	600	141	3·58	2500

TABLE No. 58.—THICKNESS OF RUBBER INSULATION. (As recommended by the Verband Deutscher Elektrotechniker for 1000 Volts Working Pressure.)

Section of Conductor		Minimum Thickness		Maximum Thickness	
sq. mm.	sq. inch	mm.	mils	mm.	mils
1·0	0·00155	0·8	31·5	1·1	43
1·5	·00232	0·8	31·5	1·1	43
2·5	·00387	1·0	39	1·4	55
4·0	·0062	1·0	39	1·4	55
6	·0093	1·0	39	1·4	55
10	·0155	1·2	47	1·7	67
16	·0248	1·2	47	1·7	67
25	·0387	1·4	55	2·0	79
35	·0542	1·4	55	2·0	79
50	·0775	1·6	63	2·3	90·7
70	·1085	1·6	63	2·3	90·7
95	·147	1·8	71	2·6	102
120	·186	1·8	71	2·6	102
150	·232	2·0	79	2·8	110
185	·286	2·2	86·6	3·0	118
240	·372	2·4	94·5	3·2	126
310	·480	2·6	102	3·4	134
400	·620	2·8	110	3·6	142
500	·775	3·2	126	4·0	157·5
625	·968	3·2	126	4·0	157·5
800	1·240	3·5	138	4·5	177
1000	1·550	3·5	138	4·5	177

TABLE No. 59.—THICKNESS OF RUBBER INSULATION FOR LOW TENSION CABLES. (Average English practice.)

Conductor L.S.W.G.	Diam. in mils over			Conductor L.S.W.G.	Diam. in mils over			Conductor L.S.W.G.	Diam. in mils over		
	Conductor	Pure	V.I.R.		Conductor	Pure	V.I.R.		Conductor	Pure	V.I.R.
23/36	45	61	113	3/18	103	119	183	19/14	400	424	540
40/36	60	76	132	7/25	60	76	132	19/13	460	484	612
70/36	72	88	146	7/23	72	88	146	19/12	520	544	684
41/30	86	102	162	7/22	84	100	160	37/18	336	360	463
83/30	130	146	216	7/21½	90	106	168	37/17	392	416	530
124/30	156	172	246	7/21	96	112	175	37/16	448	472	597
172/38	100	116	180	7/20	108	124	189	37/15	504	528	664
1/20	36	52	104	7/19	120	140	204	37/14	560	584	732
1/19	40	56	108	7/18	144	164	232	37/13	644	668	832
1/18	48	64	118	7/17	168	188	261	37/12	728	752	933
1/17	56	72	127	7/16	192	212	290	61/18	432	456	580
1/16	64	80	136	7/15	216	240	319	61/16	576	600	750
1/15	72	88	146	7/14	240	264	348	61/14	720	744	924
1/14	80	96	156	19/22	140	160	228	61/13	828	852	1052
1/13	92	108	170	19/21	160	180	252	61/12	936	960	1183
1/12	104	120	184	19/20	180	200	276	91/14	880	904	1116
3/25	43	59	111	19/19	200	220	300	91/13	1012	1036	1274
3/23	52	68	122	19/18	240	264	348	91/12	1144	1168	1432
3/22	60	76	132	19/17	280	304	396	91/11	1276	1300	1591
3/21	69	85	143	19/16	320	344	444				
3/20	78	94	153	19/15	360	384	492				

The weight of an annulus of rubber in kilogrammes per kilometre is equal to

$$(A - a) \times \text{specific gravity},$$

where A is the area in square millimetres corresponding to the over-all diameter of the annulus, and a is the area in square millimetres corresponding to the internal diameter of the annulus.

Table No. 60 gives the areas of circles for diameters from 0 to 100.

TABLE No. 60.—AREAS OF CIRCLES.

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
0	0·0000	0·0079	0·0314	0·0707	0·1257	0·1964	0·2827	0·3848	0·5026	0·6362
1	0·7854	0·9503	1·1310	1·3273	1·5394	1·7671	2·0106	2·2698	2·5447	2·8353
2	3·1416	3·4636	3·8013	4·1548	4·5239	4·9087	5·3093	5·7236	6·1575	6·6052
3	7·0686	7·5477	8·0425	8·5530	9·0792	9·6211	10·179	10·752	11·341	11·946
4	12·566	13·203	13·854	14·522	15·205	15·904	16·619	17·349	18·096	18·857
5	19·635	20·428	21·237	22·062	22·902	23·758	24·630	25·518	26·421	27·340
6	28·274	29·225	30·191	31·172	32·170	33·183	34·212	35·257	36·317	37·393
7	38·485	39·592	40·715	41·854	43·008	44·179	45·365	46·566	47·784	49·017
8	50·265	51·530	52·810	54·106	55·418	56·745	58·088	59·447	60·821	62·211
9	63·617	65·039	66·476	67·929	69·398	70·882	72·382	73·898	75·430	76·977
10	78·540	80·118	81·713	83·323	84·949	86·590	88·247	89·920	91·609	93·313
11	95·033	96·769	98·520	100·29	102·07	103·87	105·68	107·51	109·36	111·22
12	113·10	114·99	116·90	118·82	120·76	122·72	124·69	126·68	128·68	130·70
13	132·73	134·78	136·85	138·93	141·03	143·14	145·27	147·41	149·57	151·75
14	153·94	156·15	158·37	160·61	162·86	165·13	167·42	169·72	172·03	174·37
15	176·71	179·08	181·46	183·85	186·27	188·69	191·13	193·59	196·07	198·56
16	201·06	203·58	206·12	208·67	211·24	213·82	216·42	219·04	221·67	224·32
17	226·98	229·66	232·35	235·06	237·79	240·53	243·28	246·06	248·85	251·65
18	254·47	257·30	260·16	263·02	265·90	268·80	271·72	274·65	277·59	280·55
19	283·53	286·52	289·53	292·55	295·59	298·65	301·72	304·81	307·91	311·03
20	314·16	317·31	320·47	323·65	326·85	330·06	333·29	336·54	339·79	343·07
21	346·36	349·67	352·99	356·33	359·68	363·05	366·44	369·84	373·25	376·68
22	380·13	383·60	387·08	390·57	394·08	397·61	401·15	404·71	408·28	411·87
23	415·48	419·10	422·73	426·38	430·05	433·74	437·44	441·15	444·88	448·63
24	452·39	456·17	459·96	463·77	467·59	471·44	475·29	479·16	483·05	486·95
25	490·87	494·81	498·76	502·73	506·71	510·71	514·72	518·75	522·79	526·85
26	530·93	535·02	539·13	543·25	547·39	551·55	555·72	559·90	564·10	568·32

TABLE NO. 60.—AREAS OF CIRCLES—*continued.*

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
27	572·56	576·80	581·07	585·35	589·65	593·96	598·28	602·63	606·99	611·36
28	615·75	620·16	624·58	629·02	633·47	637·94	642·42	646·92	651·44	655·97
29	660·52	665·08	669·66	674·26	678·87	683·49	688·13	692·79	697·46	702·15
30	706·86	711·58	716·31	721·07	725·83	730·62	735·42	740·23	745·06	749·91
31	754·77	759·64	764·54	769·44	774·37	779·31	784·27	789·24	794·23	799·23
32	804·25	809·28	814·33	819·40	824·48	829·58	834·69	839·82	844·96	850·12
33	855·30	860·49	865·70	870·92	876·16	881·41	886·68	891·97	897·27	902·59
34	907·92	913·27	918·63	924·01	929·41	934·82	940·25	945·69	951·15	956·62
35	962·11	967·62	973·14	978·68	984·23	989·80	995·38	1001·0	1006·6	1012·2
36	1017·9	1023·5	1029·2	1034·9	1040·6	1046·3	1052·1	1057·8	1063·6	1069·4
37	1075·2	1081·0	1086·9	1092·7	1098·6	1104·5	1110·4	1116·3	1122·2	1128·1
38	1134·1	1140·1	1146·1	1152·1	1158·1	1164·2	1170·2	1176·3	1182·4	1188·5
39	1194·6	1200·7	1206·9	1213·0	1219·2	1225·4	1231·6	1237·9	1244·1	1250·4
40	1256·6	1262·9	1269·2	1275·6	1281·9	1288·2	1294·6	1301·0	1307·4	1313·8
41	1320·3	1326·7	1333·2	1339·6	1346·1	1352·7	1359 2	1365·7	1372·3	1378·9
42	1385·4	1392·0	1398·7	1405·3	1412·0	1418·6	1425·3	1432·0	1438·7	1445·5
43	1452·2	1459·0	1465·7	1472·5	1479·3	1486·2	1493·0	1499·9	1506·7	1513·6
44	1520·5	1527·5	1534·4	1541·3	1548·3	1555·3	1562·3	1569·3	1576·3	1583·4
45	1590·4	1597·5	1604·6	1611·7	1618·8	1626·0	1633·1	1640·3	1647·5	1654·7
46	1661·9	1669·1	1676·4	1683·7	1690·9	1698·2	1705·5	1712·9	1720·2	1727·6
47	1734·9	1742·3	1749·7	1757·2	1764·6	1772·1	1779·5	1787·0	1794·5	1802·0
48	1809·6	1817·1	1824·7	1832·2	1839·8	1847·5	1855·1	1862·7	1870·4	1878·1
49	1885·7	1893·4	1901·2	1908·9	1916·7	1924·4	1932·2	1940·0	1947·8	1955·6
50	1963·5	1971·4	1979·2	1987·1	1995·0	2003·0	2010·9	2018·9	2026·8	2034·8
51	2042·8	2050·8	2058·9	2066·9	2075·0	2083·1	2091·2	2099·3	2107·4	2115·6
52	2123·7	2131·9	2140·1	2148·3	2156·5	2164·8	2173·0	2181·3	2189·6	2197·9
53	2206·2	2214·5	2222·9	2231·2	2239·6	2248·0	2256·4	2264·8	2273·3	2281·7

TABLE No. 60.—AREAS OF CIRCLES—*continued.*

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
54	2290·2	2298·7	2307·2	2315·7	2324·3	2332 8	2341·4	2350·0	2358·6	2367·2
55	2375·8	2384·5	2393·1	2401·8	2410·5	2419·2	2427·9	2436·7	2445·4	2454·2
56	2463·0	2471·8	2480·6	2489·5	2498·3	2507·2	2516·1	2525·0	2533·9	2542·8
57	2551·8	2560·7	2569·7	2578·7	2587·7	2596·7	2605·8	2614·8	2623·9	2633·0
58	2642·1	2651·2	2660·3	2669·5	2678·6	2687·8	2697·0	2706·2	2715·5	2724·7
59	2734	2743	2752	2762	2771	2780	2790	2799	2809	2818
60	2827	2837	2846	2856	2865	2875	2884	2894	2903	2913
61	2922	2932	2942	2951	2961	2971	2980	2990	3000	3009
62	3019	3029	3039	3048	3058	3068	3078	3088	3097	3107
63	3117	3127	3137	3147	3157	3167	3177	3187	3197	3207
64	3217	3227	3237	3247	3257	3267	3278	3288	3298	3308
65	3318	3328	3339	3349	3359	3370	3380	3390	3400	3411
66	3421	3432	3442	3452	3463	3473	3484	3494	3505	3515
67	3526	3536	3547	3557	3568	3578	3589	3600	3610	3621
68	3632	3642	3653	3664	3674	3685	3696	3707	3718	3728
69	3739	3750	3761	3772	3783	3794	3805	3815	3826	3837
70	3848	3859	3870	3881	3893	3904	3915	3926	3937	3948
71	3959	3970	3981	3993	4004	4015	4026	4038	4049	4060
72	4071	4083	4094	4105	4117	4128	4140	4151	4162	4174
73	4185	4197	4208	4220	4231	4243	4254	4266	4278	4289
74	4301	4312	4324	4336	4347	4359	4371	4383	4394	4406
75	4418	4430	4441	4453	4465	4477	4489	4501	4513	4524
76	4536	4548	4560	4572	4584	4596	4608	4620	4632	4644
77	4657	4669	4681	4693	4705	4717	4729	4742	4754	4766
78	4778	4791	4803	4815	4827	4840	4852	4864	4877	4889
79	4902	4914	4926	4939	4951	4964	4976	4989	5001	5014
80	5026	5039	5052	5064	5077	5090	5102	5115	5128	5140

TABLE NO. 60.—AREAS OF CIRCLES—*continued.*

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
81	5153	5166	5178	5191	5204	5217	5230	5242	5255	5268
82	5281	5294	5307	5320	5333	5346	5359	5372	5385	5400
83	5411	5424	5437	5450	5463	5476	5489	5502	5515	5529
84	5542	5555	5568	5581	5595	5608	5621	5634	5648	5661
85	5674	5688	5701	5715	5728	5741	5755	5768	5782	5795
86	5809	5822	5836	5849	5863	5876	5890	5904	5917	5931
87	5945	5958	5972	5986	5999	6013	6027	6041	6054	6068
88	6082	6096	6110	6124	6137	6151	6165	6179	6193	6207
89	6221	6235	6249	6263	6277	6291	6305	6319	6333	6348
90	6362	6376	6390	6404	6418	6433	6447	6461	6475	6490
91	6504	6518	6532	6547	6561	6575	6590	6604	6619	6633
92	6648	6662	6676	6691	6705	6720	6735	6749	6764	6778
93	6793	6807	6822	6837	6851	6866	6881	6896	6910	6925
94	6940	6955	6969	6984	6999	7014	7029	7043	7058	7073
95	7088	7103	7118	7133	7148	7163	7178	7193	7208	7223
96	7238	7253	7268	7283	7299	7314	7329	7344	7359	7375
97	7390	7405	7420	7436	7451	7466	7481	7497	7512	7528
98	7543	7558	7574	7589	7605	7620	7636	7651	7667	7682
99	7698	7713	7729	7744	7760	7776	7791	7807	7823	7838
100	7854	..	..	..	..	..	..	..	..	..

The specific gravity of the compound rubber used for insulating cables varies between 1·3 and 1·7, according to the amount and nature of the added minerals. Table No. 61 gives the average values for various rubbers.

TABLE No. 61.—SPECIFIC GRAVITY OF RUBBERS.

Grade of Rubber	Specific Gravity
Pure rubber	0·935 or 1·0
Compound rubber for 300 and 600 megohm grade low tension .	1·6 to 1·7
,, ,, ,, 2500 megohm grade low tension . .	1·6
,, ,, ,, high-tension cable	1·5
Best quality compound rubber	1·3 to 1·4

The thickness of the pure rubber layer applied by the various manufacturers varies considerably. Table No. 62 gives the approximate maximum and minimum values for various diameters of the conductor.

TABLE No. 62.—THICKNESS OF PURE RUBBER.

Diameter of Conductor		Minimum Thickness		Maximum Thickness	
mils	mm.	mils	mm.	mils	mm.
40	1·01	8	0·2	16	0·41
80	2·03	8	0·2	20	0·51
100	2·54	8	0·2	24	0·61
150	3·82	10	0·25	30	0·76
200	5·09	10	0·25	34	0·86
250	6·35	12	0·30	36	0·915
300	7·63	12	0·30	40	1·02
350	8·90	12	0·30	42	1·065
400	10·16	12	0·30	48	1·22
500	12·70	12	0·30	48	1·22
600	15·23	12	0·30	50	1·27
700	17·80	12	0·30	58	1·47

Weight of Pure Rubber.

Let x = thickness of pure rubber tape in millimetres,
d = diameter over the conductor in millimetres.
then $d + 2x$ = equivalent diameter over the pure rubber.

In the case of stranded conductors, $(d + 2x)$ is not the actual diameter over the pure rubber, owing to the fact that the rubber is forced into the spaces between the outer wires of the strand.

The sectional area of the pure rubber will be equal to

$$\frac{\pi}{4}\left\{(d + 2x)^2 - d^2\right\} = \pi\,(x^2 + dx).$$

Taking the specific gravity of pure rubber as 1·0, the weight of pure rubber will be equal to

$$\pi x\,(d + x) \text{ kilogrammes per kilometre.}$$

Table No. 63 gives the weight of pure rubber for various thicknesses; d is the diameter over the conductor in millimetres.

Table No. 63.—Weight of Pure Rubber.

Thickness of Pure Rubber		Weight of Pure Rubber	
mils	mm.	kilogrammes per kilometre	lb, per statute mile
8	0·203	$0·637\,d + 0·129$	$2·26\,d + 0·458$
10	0·254	$0·798\,d + 0·202$	$2·83\,d + 0·717$
12	0·305	$0·957\,d + 0·292$	$3·40\,d + 1·04$
14	0·356	$1·117\,d + 0·398$	$3·98\,d + 1·41$
16	0·407	$1·278\,d + 0·520$	$4·54\,d + 1·85$
20	0·510	$1·6\,d + 0·815$	$5·68\,d + 2·89$
24	0·610	$1·9\,d + 1·16$	$6·75\,d + 4·12$
30	0·760	$2·4\,d + 1·83$	$8·52\,d + 6·50$
34	0·860	$2·7\,d + 2·32$	$9·58\,d + 8·25$
36	0·915	$2·9\,d + 2·65$	$10·3\,d + 9·41$
40	1·020	$3·2\,d + 3·26$	$11·3\,d + 11·6$
42	1·065	$3·34\,d + 3·56$	$11·8\,d + 12·6$
48	1·220	$3·83\,d + 4·66$	$13·6\,d + 16·6$
50	1·270	$3·98\,d + 5·06$	$14·1\,d + 18·0$
58	1·470	$4·61\,d + 6·78$	$16·35\,d + 24·0$

The weight of compound rubber applied over the pure rubber can be calculated in the following way:—

Let D be the diameter over the compound rubber and d the diameter of the conductor, then the total cross section of rubber (pure and compound) is equal to $\frac{\pi}{4}\,(\mathrm{D}^2 - d^2)$ plus the area of the small amount of rubber forced between the wires composing the outside layer of the conductor strand. The total cross section of rubber can be written equal to

$$\left(\frac{\pi}{4}\,\mathrm{D}^2 - c\,\frac{\pi}{4}\,d^2\right),$$

where c is a constant, depending upon the number of wires in the outside

layer of the strand, or, of course, depending upon the total number of wires in the strand. Its value is as follows:—

For a strand of 7 wires	$c = 0{\cdot}80$
„ „ „ 14 „	$0{\cdot}81$
„ „ „ 19 „	$0{\cdot}85$
„ „ „ 37 „	$0{\cdot}87$
„ „ „ 61 „	$0{\cdot}88$
„ „ above 61 wires	$0{\cdot}90$
„ solid conductor	$1{\cdot}00$

If P be the weight of pure rubber in kilogrammes per kilometre, then the cross section of the pure rubber will be P square millimetres (because specific gravity is approximately $1{\cdot}0$).

Therefore the cross section of the compound rubber will be

$$\frac{\pi}{4}\left\{D^2 - c\,d^2\right\} - P,$$

and the weight of compound rubber in kilogrammes per kilometre will be (d and D being given in millimetres)

$$\left[\frac{\pi}{4}\left\{D^2 - c\,d^2\right\} - P\right] \times \text{specific gravity},$$

or,

$$\left\{\frac{\pi\,D^2}{4} - c\left(\frac{\pi\,d^2}{4}\right) - P\right\} \times \text{specific gravity}.$$

The areas $\frac{\pi\,D^2}{4}$ and $\frac{\pi\,d^2}{4}$ can be seen in Table No. 60.

The weights of pure and compound rubber can be also calculated from the actual diameter over the pure rubber, and the diameter over the compound rubber; thus:

Let d = diameter of conductor in mm.,
D_1 = diameter over the pure rubber in mm.,
D_2 = diameter over the compound rubber in mm.,

then the weight of pure rubber will be

$$\left\{\frac{\pi\,D_1^2}{4} - c\left(\frac{\pi\,d^2}{4}\right)\right\} \text{kilogrammes per kilometre},$$

and the weight of compound rubber will be

$$\left\{\left(\frac{\pi\,D_2^2}{4} - \frac{\pi\,D_1^2}{4}\right) \times (\text{specific gravity})\right\} \text{kilogrammes per kilometre}.$$

The following Table No. 64 gives the price of washed Para Rubber exclusive of wages for various market prices of the raw Para rubber; the table is based upon a 17 per cent. loss in washing, which is the average value.

The prices of the various compound rubber ingredients vary from time to time, but the effect of such variation upon the price of the compound rubber is very small; further, the price of a compound rubber containing a given percentage of Para rubber, varies only with the market price of Para, for although each manufacturer may have his own particular mixing, the allowable differences in the percentages of the various ingredients influence the price of the compound rubber very little.

TABLE No. 64.—PRICE OF PARA RUBBER IN SHILLINGS.

Market Price per lb.		Price Cleaned excluding Wages		Market Price per lb.		Price Cleaned excluding Wages	
		per lb.	per kilog.			per lb.	per kilog.
s.	d.			s.	d.		
7	0	8·43	18·58	5	0	6·02	13·27
6	11	8·33	18·36	4	11	5·92	13·05
6	10	8·23	18·14	4	10	5·82	12·83
6	9	8·13	17·92	4	9	5·72	12·61
6	8	8·03	17·70	4	8	5·62	12·39
6	7	7·93	17·48	4	7	5·52	12·17
6	6	7·83	17·26	4	6	5·42	11·95
6	5	7·73	17·04	4	5	5·32	11·73
6	4	7·63	16·82	4	4	5·22	11·51
6	3	7·53	16·60	4	3	5·12	11·29
6	2	7·43	16·38	4	2	5·02	11·07
6	1	7·33	16·16	4	1	4·92	10·85
6	0	7·23	15·94	4	0	4·82	10·63
5	11	7·13	15·72	3	11	4·72	10·41
5	10	7·03	15·50	3	10	4·62	10·18
5	9	6·93	15·28	3	9	4·52	9·96
5	8	6·83	15·06	3	8	4·42	9·74
5	7	6·73	14·86	3	7	4·32	9·52
5	6	6·63	14·62	3	6	4·22	9·29
5	5	6·53	14·40	3	5	4·12	9·08
5	4	6·43	14·18	3	4	4·02	8·95
5	3	6·33	13·96	3	3	3·92	8·63
5	2	6·22	13·71	3	2	3·82	8·41
5	1	6·12	13·49	3	1	3·72	8·19

TABLE No. 65.—PRICES OF COMPOUND RUBBER INGREDIENTS.

Material	Average Specific Gravity	Chemical Formula	Price in Shillings per	
			100 lb.	100 kilog.
Zinc Oxide	5·0	ZnO	12·5	27·5
French Chalk	2·5	$Mg_3Si_4O_{12}H_2$	3·64	8·0
Sulphur	2·06	S	11·4	25·0
Ceresine	0·86	..	45·5	100·0
Magnesia	3·0	MgO	86·3	190·0
Prepared Lime	2·38	CaO	9·08	20·0
Red Lead	7·6	Pb_3O_4	13·6	30·0
Chalk	2·65	$CaCO_3$	2·0	4·4
Plaster of Paris	2·9	$CaSO_4$	2·0	4·4
Vegetable Black ..	2·5	C	25·0	55·0
Lamp Black	2·5	C	25·0	55·0
Zinc White (Lithophone)	4·2	$ZnS : BaSO_4$	12·5	27·5
Whiting (Paris White) ..	2·7	$CaCO_3$	2·0	4·4
Litharge	9·0	PbO	23·6	52·0
Gypsum (Pearl White) ..	3·2	$CaSO_4 \cdot 2H_2O$	7·7	17·0

Since going to press, the market price of raw Para rubber has increased to such a high figure that an extension to Table No. 64 is necessitated.

Table No. 64.—Price of Para Rubber in Shillings—(*continued*).

Market Price per lb.		Price Cleaned excluding Wages.		Market Price per lb.		Price Cleaned excluding Wages.	
		per lb.	per kilog.			per lb.	per kilog.
s.	*d.*			*s.*	*d.*		
10	0	12·05	26·56	8	6	10·24	22·57
9	11	11·95	26·33	8	5	10·14	22·35
9	10	11·85	26·11	8	4	10·04	22·13
9	9	11·75	25·89	8	3	9·94	21·91
9	8	11·65	25·67	8	2	9·84	21·69
9	7	11·55	25·45	8	1	9·74	21·47
9	6	11·45	25·23	8	0	9·64	21·24
9	5	11·35	25·01	7	11	9·54	21·02
9	4	11·24	24·78	7	10	9·44	20·80
9	3	11·14	24·56	7	9	9·34	20·58
9	2	11·04	24·34	7	8	9·24	20·36
9	1	10·94	24·12	7	7	9·14	20·14
9	0	10·84	23·90	7	6	9·04	19·92
8	11	10·74	23·68	7	5	8·94	19·70
8	10	10·64	23·46	7	4	8·84	19·47
8	9	10·54	23·24	7	3	8·74	19·25
8	8	10·44	23·02	7	2	8·63	19·03
8	7	10·34	22·79	7	1	8·53	18·81

Table No. 65 gives the prices of the various compound rubber ingredients, and also their average specific gravities.

Table No. 66 shows the variation of the price of compound rubber with the market price of raw Para rubber, for 28, 40, and 55 per cent. of Para rubber.

TABLE No. 66.—PRICE OF COMPOUND RUBBER IN SHILLINGS.

Market Price of Para	Price of Compound Rubber			Market Price of Para	Price of Compound Rubber		
	28 per cent.	40 per cent.	55 per cent.		28 per cent.	40 per cent.	55 per cent.
s. *d.*				*s.* *d.*			
10 0	2·96	4·15	5·63	7 1	2·14	2·99	4·03
9 11	2·94	4·12	5·59	7 0	2·12	2·95	3·98
9 10	2·92	4·09	5 54	6 11	2·10	2·92	3·93
9 9	2·89	4·05	5·50	6 10	2·07	2·89	3·89
9 8	2·87	4·02	5·46	6 9	2·05	2·85	3·84
9 7	2·84	3·99	5·41	6 8	2·02	2·82	3·80
9 6	2·82	3·95	5·37	6 7	2·00	2·79	3·75
9 5	2·80	3·92	5·32	6 6	1·98	2·75	3·71
9 4	2·78	3·89	5·28	6 5	1·95	2·72	3·66
9 3	2·75	3·85	5·23	6 4	1·93	2·69	3·61
9 2	2·73	3·82	5·18	6 3	1·91	2·65	3·57
9 1	2 70	3·79	5·13	6 2	1·89	2·62	3·52
9 0	2·68	3·75	5·08	6 1	1·87	2·59	3·47
8 11	2·66	3·72	5·04	6 0	1·85	2·56	3·43
8 10	2·64	3·69	5·00	5 11	1·83	2·52	3·38
8 9	2·61	3·65	4·95	5 10	1·81	2·49	3·34
8 8	2·59	3·62	4·90	5 9	1·79	2·46	3·30
8 7	2·56	3·59	4·86	5 8	1·75	2·42	3·26
8 6	2·54	3·55	4·81	5 7	1·73	2·39	3·21
8 5	2·52	3·52	4·77	5 6	1·71	2·36	3·15
8 4	2·49	3·49	4·72	5 5	1·69	2·32	3·11
8 3	2·47	3·45	4·67	5 4	1·66	2·30	3·07
8 2	2·44	3·42	4·63	5 3	1·64	2·25	3·02
8 1	2·42	3·39	4·58	5 2	1·62	2·21	2·98
8 0	2·40	3·35	4·53	5 1	1·58	2·19	2·92
7 11	2·37	3·32	4·48	5 0	1·56	2·15	2·88
7 10	2·35	3·29	4·44	4 11	1·54	2·13	2·84
7 9	2·33	3·25	4·39	4 10	1·52	2·08	2·80
7 8	2·30	3·22	4·35	4 9	1·50	2·04	2·76
7 7	2·28	3·19	4·30	4 8	1·48	2·02	2·69
7 6	2·26	3·15	4·25	4 7	1·46	1·98	2·65
7 5	2·23	3·12	4·21	4 6	1·44	1·96	2·60
7 4	2·21	3·09	4·17	4 5	1·40	1·92	2·56
7 3	2·19	3·05	4·11	4 4	1·37	1·88	2·52
7 2	2·16	3·02	4·07	4 3	1·35	1·85	2·46

TABLE No. 66.—PRICE OF COMPRUND RUBBER IN SHILLINGS—(*continued*).

Market Price of Para	Price of Compound Rubber 28 per cent.	40 per cent.	55 per cent.	Market Price of Para	Price of Compound Rubber 28 per cent.	40 per cent.	55 per cent.
s. *d.*				*s.* *d.*			
4 2	1·33	1·81	2·42	3 6	1·14	1·54	2·06
4 1	1·31	1·79	2·38	3 5	1·12	1·52	2·00
4 0	1·29	1·75	2·33				
3 11	1·27	1·71	2·28	3 4	1·10	1·48	1·96
3 10	1·25	1·69	2·23	3 3	1·08	1·46	1·92
				3 2	1·06	1·42	1·88
3 9	1·23	1·65	2·19	3 1	1·04	1·37	1·83
3 8	1·19	1·63	2·15	3 0	1·00	1·35	1·77
3 7	1·17	1·58	2·10				

Vulcanisation.—Numerous experiments have been carried out to determine the most suitable time and pressure for the vulcanisation of rubber-insulated cables, the results, of course, varying to a great extent with the composition of the vulcanising rubber. However, it appears advisable to keep both the time and the pressure as low as possible. Rubber which has been over-vulcanised generally becomes "short" and cracked after a comparatively short time, whilst on the other hand rubber under-vulcanised to any great extent may become "tacky" after some time; a slightly under-vulcanised rubber appears to suffer from no rapid deterioration. The following Table, No. 67, gives characteristic results :—

TABLE No. 67.—VULCANISATION.

Time =	1 hour		2 hours		2½ hours	
Steam Pressure, lb. per sq. in.	Result	Deterioration after	Result	Deterioration after	Result	Deterioration after
20	under-vulcanised	..	under-vulcanised	..	under-vulcanised	..
30	vulcanised	..	vulcanised	..	vulcanised	3 years
40	ditto	..	over-vulcanised	1 year	over-vulcanised	at once
50	over-vulcanised	2 years	ditto	at once	ditto	at once

TABLE No. 68.—PRESSURE AND TEMPERATURE OF STEAM.

Pressure in lb. per square inch	Temperature in degrees F.	Pressure in lb. per square inch	Temperature in degrees F.	Pressure in lb. per square inch	Temperature in degrees F.
1	102·02	24	237·80	48	278·35
2	126·30	25	240·05	49	279·64
3	141·65	26	242·23	50	280·90
4	153·12	27	244·33	51	282·15
5	162·37	28	246·38	52	283·38
6	170·17	29	248·36	53	284·59
7	176·94	30	250·29	54	285·78
8	182·95	31	252·17	55	286·95
9	188·36	32	254·00	56	288·11
10	193·28	33	255·78	57	289·25
11	197·81	34	257·52	58	290·37
12	202·01	35	259·22	59	291·48
13	205·93	36	260·88	60	292·57
14	209·60	37	262·51	61	293·65
14·7	212·00	38	264·09	62	294·72
15	213·07	39	265·65	63	295·77
16	216·35	40	267·17	64	296·81
17	219·45	41	268·66	65	297·83
18	222·42	42	270·12	66	298·84
19	225·26	43	271·56	67	299·84
20	227·96	44	272·97	68	300·83
21	230·57	45	274·35	69	301·81
22	233·07	46	275·70	70	302·77
23	235·48	47	277·04	71	303·73

Dielectric Resistance.—The dielectric resistance of pure rubber is approximately 18×10^9 megohms per c.c. at 15° C. after one minute's electrification. The pure and compound rubbers forming the insulation of a cable have a joint resistance varying between 10×10^9 megohms per c.c. at 15° C. after one minute's electrification, and, say, 5×10^8 megohms, according to the quality of the rubber.

Temperature Coefficient.—The rate at which the dielectric resistance of rubber decreases with increasing temperature varies somewhat with the quality and composition of the rubber. Table No. 69 gives the correction coefficients generally recognised in England, while Table No. 70 gives the coefficients used by Continental cable manufacturers.

Dielectric Constant.—The dielectric constant or specific inductive capacity of a rubber insulated cable varies between 3·0 and 5·5, according to the quality and composition of the rubber.

Dielectric Strength.—The dielectric strength of a rubber insulated cable varies between 16,000 and 25,000 volts per mm., according to the quality and composition of the rubber.

Dielectric Hysteresis.—The dielectric loss in rubber cables averages between 2·8 and 3·2 per cent. of the capacity current. Higher values can, of course, be observed on rubber cables of poor quality or bad design.

Working Temperature.—Rubber insulated cables should not be allowed to attain a higher temperature than 65° C. (149° F.).

TABLE No. 69.—TEMPERATURE COEFFICIENTS FOR THE DIELECTRIC RESISTANCE OF RUBBER CABLES.

The dielectric resistance at 60° F. is equal to the resistance at t° F., divided by the coefficient for t° F.

t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient
75	0·6804	62	0·9499	49	1·326	36	1·852
·5	·6892	·5	·9622	·5	1·343	·5	1·876
74	·6981	61	·9746	48	1·362	35	1·900
·5	·7071	·5	·9872	·5	1·378	·5	1·924
73	·7162	60	1·000	47	1·396	34	1·949
·5	·7255	·5	1·013	·5	1·414	·5	1·975
72	·7348	59	1·026	46	1·433	33	2·000
·5	·7443	·5	1·039	·5	1·451	·5	2·026
71	·7540	58	1·053	45	1·470	32	2·052
·5	·7637	·5	1·066	·5	1·489	·5	2·079
70	·7736	57	1·080	44	1·508	31	2·105
·5	·7836	·5	1·094	·5	1·528	·5	2·133
69	·7937	56	1·108	43	1·547	30	2·160
·5	·8039	·5	1·123	5	1·567	·5	2·188
68	·8143	55	1·137	42	1·587	29	2·216
·5	·8248	·5	1·152	·5	1·608	·5	2·245
67	·8355	54	1·166	41	1·629	28	2·274
·5	·8463	·5	1·182	5	1·650	·5	2·303
66	·8572	53	1·197	40	1·671	27	2·333
·5	·8683	·5	1·212	·5	1·693	·5	2·363
65	·8795	52	1·228	39	1·715	26	2·394
·5	·8909	·5	1·244	·5	1·737	·5	2·425
64	·9024	51	1·260	38	1·759	25	2·456
·5	·9140	·5	1·276	·5	1·782		
63	·9259	50	1·293	37	1·805		
·5	·9378	·5	1·309	·5	1·828		

TABLE No. 70.—TEMPERATURE COEFFICIENTS FOR THE DIELECTRIC RESISTANCE OF RUBBER CABLES.

The dielectric resistance at 15° C. is equal to the resistance at t° C. multiplied by the coefficient for t° C.

t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient
5	0·540	12·5	0·840	20	1·44	27·5	2·44
·5	·550	13	·870	·5	1·49	28	2·52
6	·560	·5	·900	21	1·55	·5	2·59
·5	·575	14	·930	·5	1·60	29	2·67
7	·590	·5	·970	22	1·66	·5	2·74
·5	·605	15	1·00	·5	1·72	30	2·82
8	·620	·5	1·04	23	1·79	·5	2·89
·5	·640	16	1·07	·5	1·85	31	2·97
9	·660	·5	1·11	24	1·92	·5	3·04
·5	·690	17	1·15	·5	1·99	32	3·12
10	·710	·5	1·20	25	2·07	·5	3·19
·5	·740	18	1·24	·5	2·14	33	3·27
11	760	·5	1·29	26	2·22	·5	3·34
·5	·790	19	1·34	·5	2·29	34	3·42
12	·810	·5	1·39	27	2·37		

(B) Gutta-Percha.

The specific gravity of gutta-percha varies between 0·97 and 0·98.
1 cubic foot weighs between 60 and 61·5 lb.
1 circular inch weighs approximately 2036 lb. per nautical mile.
The weight of gutta-percha is given by :—

$$(D^2 - d^2) \times 3\cdot146 = \text{lb. per nautical mile (D and } d \text{ in mm.);}$$

or

$$\frac{(D^2 - d^2)}{493} = \text{lb. per nautical mile (D and } d \text{ in mils);}$$

or

$$(D^2 - d^2) \times 2\cdot73 = \text{lb. per statute mile (D and } d \text{ in mm.);}$$

or

$$\frac{(D^2 - d^2)}{568} = \text{lb. per statute mile (D and } d \text{ in mils).}$$

The external diameter in mils of any gutta-percha core is given by :—

For solid conductor . . . . $\sqrt{55\,w + 493\,W}$
For strand conductor . . . . $\sqrt{70\cdot4\,w + 493\,W}$

where w and W are the weights per nautical mile of the copper and gutta-percha respectively.

If the dimensions of the core are given by the weights of copper and gutta-percha per nautical mile (w and W respectively), then the ratio of $\frac{D}{d}$ can be calculated from the formula:

$$\text{Solid conductor} \quad . \quad . \quad . \quad . \quad \frac{D}{d} = \sqrt{1 + 8 \cdot 93 \frac{W}{w}};$$

$$\text{Strand conductor} \quad . \quad . \quad . \quad . \quad \frac{D}{d} = \sqrt{1 + 8 \cdot 94 \frac{W}{w}}.$$

The following Table No. 71 gives the chief species of gutta-percha used in the manufacture of cables, together with their relative prices.

TABLE No. 71.—GUTTA-PERCHA SPECIES.

Species	Relative Price		Species	Relative Price	
	Raw	Cleaned		Raw	Cleaned
Pahang Grade I.	100	159	Banjer Red Grade I.	62	149
,, ,, II.	94·5	145	,, ,, ,, II.	59·3	145
,, ,, III.	88·5	134·6	,, ,, ,, III.	52·7	136
,, ,, IV.	82·9	125·6	Mixed Serapong	27·9	46
Bagan	57·2	92	Goolie Red Soondi	58·5	78
Bagan Soonie I.	56·7	74·4	Sarawak Soonie	27	63·7
,, ,, II.	52·2	64	Mixed Sarawak	17·7	38
,, ,, III.	47	58·5	Serapong Soonie	57·1	92
Padang Rib	11·9	..	Bulongan White	8·0	..
Cotee Red	52·6	116	Balata	38	51·4
Gutta Siak	3·5	..	White Bulug	28·4	53·1
Gutta Soh	8·9	..			

Tables Nos. 72 and 73 give the weight of solid circular gutta-percha in lb. per nautical mile.

TABLE NO. 72.—WEIGHT OF GUTTA-PERCHA IN LB. PER NAUTICAL MILE.
(Diameter in millimetres.)

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
0	0·0000	0·0320	0·1278	0·2876	0·5114	0·7990	1·1506	1·5660	2·0455	2·5888
1	3·1960	3·8672	4·6023	5·4013	6·2642	7·1910	8·1818	9·2365	10·3550	11·538
2	12·784	14·094	15·469	16·907	18·409	19·975	21·605	23·299	25·057	26·879
3	28·764	30·714	32·727	34·805	36·946	39·151	41·420	43·753	46·151	48·611
4	51·136	53·725	56·378	59·094	61·875	64·719	67·628	70·600	73·636	76·736
5	79·901	83·129	86·420	89·776	93·196	96·680	100·23	103·84	107·51	111·25
6	115·06	118·92	122·85	126·85	130·91	135·03	139·22	143·47	147·78	152·16
7	156·60	116·11	165·68	170·32	175·01	179·78	184·60	189·49	194·45	199·46
8	204·55	209·69	214·90	220·17	225·51	230·91	236·38	241·91	247·50	253·16
9	258·88	264·66	270·51	276·42	282·40	288·44	294·55	300·71	306·95	313·24
10	319·60	326·02	332·51	339·07	345·68	352·36	359·10	365·91	372·78	379·72
11	386·72	393·78	400·91	408·10	415·35	422·67	430·06	437·50	445·01	452·59
12	460·23	467·93	475·69	483·52	491·42	499·38	507·40	515·17	523·63	531·85
13	540·12	548·47	556·87	565·34	573·87	582·47	591·13	599·86	608·65	617·50
14	626·42	635·40	644·44	653·60	662·72	671·96	681·25	690·62	700·05	709·54
15	719·10	728·72	738·40	748·15	757·96	767·84	777·78	787·78	797·83	807·98
16	818·18	828·43	838·76	849·05	859·60	869·91	880·69	891·13	902·04	912·81
17	923·64	934·54	945·50	956·53	967·62	978·78	989·99	1001·3	1012·6	1024·0
18	1035·5	1047·0	1058·6	1070·3	1082·0	1093·8	1105·7	1117·1	1129·6	1141·6
19	1153·8	1165·9	1178·2	1189·5	1202·8	1215·3	1227·8	1240·3	1252·9	1265·6
20	1278·4	1291·2	1304·1	1317·0	1330·0	1343·1	1356·2	1368·5	1382·6	1396·0
21	1409·4	1422·9	1436·4	1450·1	1463·6	1477·3	1491·1	1505·0	1518·9	1532·8
22	1546·9	1561·9	1575·1	1589·3	1603·6	1617·0	1632·4	1646·9	1661·4	1676·0
23	1690·7	1705·4	1721·2	1736·1	1750·0	1765·0	1780·0	1795·2	1810·3	1825·6
24	1840·9	1856·3	1871·7	1887·2	1902·8	1918·4	1934·1	1949·8	1965·7	1981·6
25	1997·5	..	..	..	..	..	..	..	..	..

Lb. per nautical mile × 0·8673 = lb. per statute mile. Lb. per nautical mile × 0·2444 = kilog. per kilometre.

TABLE No. 73.—WEIGHT OF GUTTA-PERCHA IN LB. PER NAUTICAL MILE.
(Diameter in mils.)

Diam.	0	1	2	3	4	5	6	7	8	9
0	0·00000	0·00206	0·00825	0·01856	0·03299	0·05155	0·07423	0·10103	0·13196	0·16701
10	0·20619	0·24948	0·29691	0·34845	0·40412	0·46392	0·52783	0·59588	0·66804	0·74433
20	0·82474	0·90928	0·99794	1·0907	1·1876	1·2887	1·3938	1·5031	1·6165	1·7340
30	1·8557	1·9814	2·1113	2·2454	2·3835	2·5258	2·6722	2·8227	2·9773	3·1361
40	3·2990	3·4660	3·6371	3·8124	3·9917	4·1753	4·3629	4·5546	4·7505	4·9505
50	5·1546	5·3629	5·5753	5·7918	6·0124	6·2371	6·4660	6·6990	6·9361	7·1773
60	7·4227	7·6722	7·9258	8·1835	8·4454	8·7113	8·9814	9·2557	9·5340	9·8165
70	10·103	10·394	10·689	10·988	11·291	11·598	11·909	12·225	12·544	12·868
80	13·196	13·528	13·864	14·204	14·548	14·897	15·249	15·606	15·967	16·332
90	16·701	17·074	17·451	17·833	18·218	18·608	19·002	19·400	19·802	20·208
100	20·618	21·033	21·451	21·874	22·301	22·732	23·167	23·606	24·049	24·497
110	24·948	25·404	25·864	26·328	26·796	27·268	27·744	28·225	28·709	29·198
120	29·691	30·188	30·689	31·194	31·703	32·216	32·734	33·256	33·781	34·311
130	34·845	35·383	35·926	36·472	37·023	37·577	38·136	38·699	39·266	39·837
140	40·412	40·992	41·575	42·163	42·755	43·350	43·950	44·555	45·163	45·775
150	46·392	47·012	47·637	48·266	48·899	49·536	50·177	50·823	51·472	52·126
160	52·783	53·445	54·111	54·781	55·456	56·134	56·816	57·503	58·194	58·889
170	59·588	60·291	60·998	61·709	62·425	63·144	63·868	64·596	65·328	66·064
180	66·804	67·548	68·297	69·049	69·806	70·567	71·332	72·101	72·874	73·652
190	74·433	75·219	76·008	76·802	77·600	78·402	79·208	80·019	80·833	81·652
200	82·474	83·301	84·132	84·967	85·806	86·649	87·497	88·348	89·204	90·064
210	90·928	91·796	92·668	93·544	94·425	95·309	96·198	97·091	97·988	98·889
220	99·794	100·70	101·62	102·53	103·46	104·38	105·31	106·24	107·18	108·13
230	109·07	110·02	110·98	111·94	112·90	113·87	114·84	115·81	116·79	117·77
240	118·76	119·75	120·75	121·75	122·75	123·76	124·77	125·79	126·81	127·84

Lb. per nautical mile × 0·8673 = lb. per statute mile. Lb. per nautical mile × 0·2444 = kilog. per kilometre.

TABLE No. 73.—WEIGHT OF GUTTA-PERCHA IN LB. PER NAUTICAL MILE—*continued.*
(Diameter in mils.)

Diam.	0	1	2	3	4	5	6	7	8	9
250	128·87	129·90	130·94	131·98	133·02	134·07	135·13	136·18	137·24	138·31
260	139·38	140·46	141·53	142·62	143·70	144·79	145·89	146·99	148·09	149·20
270	150·31	151·42	152·54	153·67	154·80	155·93	157·06	158·20	159·35	160·50
280	161·65	162·81	163·97	165·13	166·30	167·47	168·65	169·83	171·02	172·21
290	173·40	174·60	175·80	177·01	178·22	179·43	180·65	181·87	183·10	184·33
300	185·57	186·81	188·05	189·30	190·55	191·80	193·06	194·33	195·60	196·87
310	198·14	199·42	200·71	202·00	203·29	204·59	205·89	207·19	208·50	209·82
320	211·13	212·46	213·78	215·11	216·44	217·78	219·13	220·47	221·82	223·18
330	224 54	225·90	227·27	228·64	230·01	231·39	232·77	234·16	235·55	236·95
340	238·35	239·75	241·16	242·57	243·99	245·41	246·84	248·27	249·70	251·14
350	252·58	254·02	255 47	256·93	258·38	259·84	261·31	262·78	264·26	265·73
360	267·22	268·70	270·19	271·69	273·19	274·69	276·20	277·71	279·22	280·74
370	282·27	283·80	285·33	286·86	288·40	289·95	291·50	293·05	294·61	296·17
380	297·73	299·30	300·87	302·45	304·03	305·62	307·21	308·80	310·40	312·00
390	313·61	315·22	316·83	318·45	320·07	321·70	323·33	324·97	326·61	328·25
400	329·90	331·55	333·20	334·86	336·53	338·20	339·87	341·54	343·22	344·91
410	346·60	348·29	349·99	351·69	353·39	355·10	356·82	358·53	360·26	361·98
420	363·71	365·44	367·18	368·92	370·67	372·42	374·18	375·94	377·70	379·47
430	381·24	383·01	384·79	386·57	388·36	390·15	391·95	393·75	395·55	397·36
440	399·17	400·99	402·81	404·64	406·47	408·30	410·14	411·98	413·82	415·67
450	417·53	419·38	421·24	423·11	424·98	426·86	428·73	430·62	432·50	434·39
460	436·29	438·19	440·09	442·00	443·91	445·82	447·94	449·67	451·60	453·53
470	455·46	457·40	459·35	461·30	463·25	465·21	467·17	469·13	471·10	473·07
480	475·05	477·03	479·02	481·01	483·00	485·00	487·00	489·01	492·02	493·03
490	495·05	497·07	499·10	501·13	503·17	505·21	507·25	509·30	511·35	513·40
500	515·46	..	..	..	..	..	..	..	..	..

Lb. per nautical mile × 0·8673 = lb. per statute mile. Lb. per nautical mile × 0·2444 = kilog. per kilometre.

Dielectric Resistance.—The dielectric resistance of a gutta-percha insulated cable is approximately $3 \cdot 5 \times 10^8$ megohms per c.c. at 75° F. after one minute's electrification.

Temperature Coefficient.—The rate at which the dielectric resistance of gutta-percha decreases with increasing temperature varies somewhat with the quality and newness of the gutta-percha. Table No. 74 gives the coefficients for 1·082, 1·085, 1·089, and 1·090 per degree F.; the latter and higher coefficients being for new gutta-percha cable.

Table No. 75 gives the coefficients founded on the tests of Winnertz published in the "Elektrotechniker Zeitschrift" (November 29, 1906). Herr Winnertz pointed out peculiarities in the dielectric resistance curve at certain temperatures.

Dielectric Constant.—The dielectric constant or specific inductive capacity of a gutta-percha insulated cable is approximately 3·6.

Dielectric Strength.—The dielectric strength of gutta-percha is approximately 18,000 volts per mm.

TABLE No. 74.—TEMPERATURE COEFFICIENTS FOR THE DIELECTRIC RESISTANCE OF GUTTA-PERCHA CABLE.

The dielectric resistance at 75° F. is equal to the resistance at t° F. divided by the coefficient for t° F.

t° F.	0·082 per deg.	0·085 per deg.	0·089 per deg.	0·090 per deg.	t° F.	0·082 per deg.	0·085 per deg.	0·089 per deg.	0·090 per deg.
90	0·3066	0·2941	0·2783	0·2745	75	1·000	1·000	1·000	1·000
·5	·3189	·3065	·2904	·2866	·5	1·040	1·042	1·044	1·044
89	·3317	·3191	·3031	·2992	74	1·082	1·085	1·089	1·090
·5	·3451	·3325	·3163	·3124	·5	1·126	1·130	1·136	1·138
88	·3590	·3463	·3301	·3261	73	1·171	1·177	1·186	1·188
·5	·3734	·3608	·3445	·3405	·5	1·218	1·226	1·238	1·240
87	·3884	·3757	·3594	·3555	72	1·267	1·277	1·291	1·295
·5	·4040	·3914	·3751	·3711	·5	1·318	1·331	1·348	1·352
86	·4202	·4076	·3914	·3875	71	1·371	1·386	1·406	1·412
·5	·4371	·4247	·4085	·4046	·5	1·426	1·444	1·468	1·474
85	·4547	·4423	·4263	·4222	70	1·483	1·503	1·532	1·539
·5	·4730	·4600	·4449	·4410	·5	1·543	1·566	1·598	1·606
84	·4920	·4799	·4612	·4604	69	1·605	1·632	1·668	1·677
·5	·5117	·4999	·4845	·4807	·5	1·669	1·700	1·741	1·751
83	·5323	·5207	·5055	·5018	68	1·736	1·770	1·816	1·828
·5	·5537	·5424	·5275	·5239	·5	1·806	1·844	1·895	1·909
82	·5759	·5649	·5505	·5470	67	1·878	1·921	1·979	1·993
·5	·5999	·5885	·5745	·5711	·5	1·954	2·001	2·064	2·081
81	·6232	·6130	·5995	·5962	66	2·033	2·084	2·154	2·172
·5	·6482	·6385	·6257	·6225	·5	2·114	2·170	2·248	2·268
80	·6743	·6650	·6529	·6499	65	2·199	2·261	2·346	2·368
·5	·7014	·6928	·6813	·6785	·5	2·288	2·355	2·448	2·472
79	·7297	·7216	·7110	·7084	64	2·380	2·453	2·555	2·581
·5	·7589	·7516	·7420	·7396	·5	2·475	2·555	2·666	2·694
78	·7894	·7829	·7743	·7722	63	2·575	2·662	2·782	2·813
·5	·8212	·8155	·8080	·8070	·5	2·678	2·773	2·902	2·937
77	·8542	·8495	·8432	·8417	62	2·786	2·890	3·030	3·066
·5	·8885	·8848	·8800	·8787	·5	2·898	3·006	3·162	3·201
76	·9242	·9217	·9183	·9174	61	3·014	3·133	3·299	3·342
·5	·9613	·9600	·9583	·9578	·5	3·135	3·264	3·443	3·489

TABLE No. 74.—TEMPERATURE COEFFICIENTS FOR THE DIELECTRIC RESISTANCE OF GUTTA-PERCHA CABLE—*continued.*

The dielectric resistance at 75° F. is equal to the resistance at t° F. divided by the coefficient for t° F.

t° F.	0·082 per deg.	0·085 per deg.	0·089 per deg.	0·090 per deg.	t° F.	0·082 per deg.	0·085 per deg.	0·089 per deg.	0·090 per deg.
60	3·262	3·400	3·593	3·643	50·5	7·461	8·006	8·795	9·005
·5	3·393	3·541	3·749	3·802	49	7·761	8·340	9·179	9·401
59	3·529	3·688	3·913	3·971	·5	8·073	8·688	9·578	9·815
·5	3·671	3·841	4·083	4·146	48	8·397	9·049	9·996	10·25
58	3·818	4·002	4·261	4·328	·5	8·735	9·425	10·43	10·70
·5	3·970	4·170	4·446	4·518	47	9·086	9·818	10·89	11·17
57	4·131	4·342	4·640	4·718	·5	9·451	10·23	11·36	11·66
·5	4·297	4·523	4·842	4·926	46	9·831	10·65	11·85	12·17
56	4·470	4·712	5·053	5·142	·5	10·23	11·10	12·37	12·71
·5	4·650	4·908	5·273	5·369	45	10·64	11·56	12·91	13·27
55	4·837	5·112	5·503	5·605	·5	11·06	12·04	13·47	13·85
·5	5·031	5·325	5·743	5·852	44	11·51	12·54	14·06	14·46
54	5·233	5·546	5·993	6·110	·5	11·97	13·06	14·67	15·10
·5	5·444	5·777	6·254	6·379	43	12·45	13·61	15·31	15·77
53	5·662	6·017	6·526	6·660	·5	12·95	14·17	15·98	16·46
·5	5·890	6·269	6·810	6·953	42	13·47	14·76	16·67	17·19
52	6·127	6·530	7·107	7·259	·5	14·02	15·35	17·40	17·94
·5	6·373	6·801	7·416	7·579	41	14·58	16·02	18·16	18·73
51	6·629	7·085	7·740	7·913	·5	15·16	16·68	18·95	19·56
·5	6·896	7·380	8·077	8·261	40	15·77	17·40	19·77	20·42
50	7·173	7·686	8·428	8·625					

TABLE No. 75.—TEMPERATURE COEFFICIENTS FOR THE DIELECTRIC RESISTANCE OF GUTTA PERCHA CABLES (Winnertz).

The dielectric resistance at 75° F. is equal to the resistance at t° F. divided by the coefficient for t° F.

t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient
95	0·1415	79	0·7066	63	2·790	47	7·943
94	·1561	78	·7707	62	3·035	46	8·178
93	·1721	77	·8406	61	3·302	45	8·383
92	·1898	76	·9168	60	3·588	44	8·499
91	·2105	75	1·000	59	3·896	43	8·585
90	·2332	74	1·089	58	4·223	42	8·637
89	·2574	73	1·187	57	4·564	41	8·678
88	·2836	72	1·293	56	4·919	40	8·719
87	·3125	71	1·409	55	5·282	39	8·757
86	·3442	70	1·535	54	5·650	38	8·796
85	·3833	69	1·672	53	6·015	37	8·834
84	·4304	68	1·821	52	6·373	36	8·880
83	·4801	67	1·984	51	6·722	35	8·932
82	·5251	66	2·161	50	7·057	34	8·990
81	·5848	65	2·353	49	7·377	33	9·053
80	·6458	64	2·562	48	7·670		

CHAPTER V.

DRY CORE TELEPHONE CABLES.

THE conductors of telephone cables are generally of solid copper wire, drawn through diamond dies, which allows of the greatest accuracy in the diameter of the wire being obtained. The conductors used vary between 0·4 mm. (15·75 mils) in diameter for local telephone services, and 3·0 mm. (118 mils) in diameter for trunk lines. Table No. 76 gives the details of various standard telephone conductors; the smaller sizes, viz.: 0·4, 0·5 and 0·6 mm. diameter, are largely used in Scandinavia for local services; in Germany 0·8 mm. diameter wire is largely used, whilst in England 0·635, 0·711 and 0·901 mm. diameter wires are used for these services.

A strand of three wires is sometimes used to form the heavier conductors.

The conductors are individually insulated with one, two or even three layers of paper, loosely applied so as to enclose more or less air space around the conductor. There are two methods of applying the paper, firstly, by spirally lapping a paper ribbon round the conductor and thus forming a closed paper helix; and secondly, by laying the paper ribbon longitudinally along the conductor and folding it round the wire by means of a suitable die, the paper being secured by a whipping of thread. The spiral method of covering is often adopted for small conductors, but the longitudinal method is much more

TABLE No. 76.—DETAILS OF CONDUCTORS FOR TELEPHONE CABLES.

Weight in lb. per statute mile	Diameter of Wire		Maximum Resistance at 60° F.	
	mils	mm.	per statute mile	per kilometre
3·98	15·75	0·4	209·0	136·0
6·21	19·7	0·5	140·0	87·0
8·94	23·6	0·6	97·3	60·5
10·0	25·0	0·635	87·8	54·6
12·16	27·6	0·7	71·6	44·5
12·5	28·0	0·711	70·3	43·6
15·9	31·5	0·8	54·9	34·1
20·0	35·5	0·901	43·9	26·96
24·8	39·4	1·0	35·0	21·75
40·0	50·0	1·27	22·0	13·63
55·7	59·1	1·5	15·6	9·67
70·0	66	1·67	12·6	7·805
100	79	2·01	8·8	5·42
150	97	2·46	5·85	3·64
200	112	2·85	4·39	2·73

extensively adopted for covering conductors with one layer of paper. When two or more layers of paper are specified, the first layer is generally longitudinally applied, and the second (and third) layer spirally lapped.

There are three methods of cabling the wires together to form a cable, known as ordinary twin, multiple twin, and quadruple twin.

Ordinary Twin.—Two insulated conductors are layed up together to form a pair, the length of lay of the wires varying between 10 cm. (4 in.) and and 30 cm. (12 in.). The two cores of a pair are made distinguishable from each other either by having one conductor of tinned copper wire, and the other of plain copper wire (Continental method), or by having differently coloured insulating paper or thread whipping (English method). The required number of such pairs are stranded together in layers, the length of lay of the neighbouring pairs being different in order to prevent inductive interference or cross talk in the circuits. The successive layers are applied with a left-handed and right-handed lay alternately, and are sometimes taped over with one layer of paper, the final layer being taped with paper or calico tape.

The cable is next dried in a vacuum heater at a temperature of approximately 130° C. (260° F.) for from 12 to 18 hours, and then lead cased.

One or two pairs of conductors in each layer are generally provided with distinctive colours, so that any wire in the cable can be identified. The ordinary twin type of cable is the most extensively used, having the advantage in economy of space; with this type of cable, however, the system of bunching the conductors to form heavier circuits is only efficiently possible on short lengths, whilst the method of telephone working, known as superimposing circuits, is efficiently impossible owing to the inductive interference inherent with this arrangement of pairs.

Multiple Twin.—The multiple twin method of cabling was suggested by Jacob (British Patent No. 3821, 1882), and consists in the successive twinning of the wires; thus two insulated conductors are layed up together to form a pair, this pair is again twinned with a similar pair to form a four-wire unit; this twinning is continued until the requisite number of conductors is obtained, which number can, of course, only be one of the geometrical progression series 4, 8, 16, 32, 64, etc.

Cables made as above described are not so economical in respect to space as the ordinary twin cables, nor have they any advantage unless the length of lay be varied for each twinning operation—an arrangement patented in 1903 by Messrs. Dieselhorst and Martin (British Patent No. 12526, 1903). This latter arrangement allows of the circuits being bunched and also of superimposed circuit working.

Quadruple Pair.—Four insulated cores are stranded together to form a "quad pair," then the requisite number of such units are stranded together to form a cable. Such cables can also be worked on the superimposed system, and also allow of the circuits being bunched together efficiently, but they have two disadvantages, firstly, the amount of unprofitable space in the cable, which disadvantage is sometimes lessened by laying in pairs of smaller conductors; secondly, the liability of cross talk between the circuits, owing to want of symmetry in the position of the four conductors. This want of symmetry, which is caused by the almost unavoidable inequality of the friction on the four bobbins of the laying-up machine, can be lessened by increasing the length of lay of the wires, but this cannot be increased beyond certain limits, else the cable would be liable to damage when handled. If, however, the four wires are laid up round a jute centre, the diagonals can be maintained at right angles to one another, and therefore cross talk cannot occur because the inductive effects of any two diagonal wires upon the other two wires will be equal and opposite.

The electrostatic capacity of the quadruple pair circuits is less than that of similar wires laid up in twins, because the diagonal wires are used to form the circuits.

The copper wire used for telephone cables is usually tested to withstand wrapping in six turns round its own diameter, unwrapping, wrapping on again, and unwrapping a second time.

The paper used to insulate the conductors should be specially tough, long fibred, having a breaking length of at least 5 kilometres (5500 yards). It is used in widths varying from 5 to 20 mm. (197 to 790 mils), and of thickness 0·0635 to 0·254 mm. (2·5 to 10 mils).

Various tensile strength tests are specified for the paper, such as:—"A strip one inch in width to support a weight of 4 lb. for each mil of thickness," or "a strip of paper 1 cm. wide and 1 metre long, after having been in water for 24 hours, and afterwards dried, shall bear a weight of 2·25 kilogrammes and allow of being turned ten times through an angle of 180° in the same direction without breaking."

Table No. 77 shows the results of various mechanical tests on paper used for the manufacture of telephone cables.

TABLE No. 77.—TESTS ON TELEPHONE CABLE PAPER.

Width mm.	Thickness mm.	Tensile Strength, kilogrammes per sq. mm.	Elongation per cent.	Breaking Length, metres	Suction Test. Mm. in Castor Oil at 100° C. after			Weight in kilogrammes per sq. metre	Specific Gravity
					10 min.	30 min.	60 min.		
6	0·090	5·63	1·1	7760	5	9	13	0·0653	0·725
6	·085	7·25	1·0	8800	7	10	14	·0697	·820
10	·155	5·08	1·6	6760	9	13	17	·1090	·705
10	·120	5·40	1·6–2·0	7660	..	..	..	..	..

The thread used for whipping the cores and pairs has an elongation of about 2·1 per cent., and an average total tensile strength of about 1·25 kilogrammes (2·75 lb.).

Paper and air space telephone cables are usually specified to admit of the free passage of air, so that after the removal and repair of a fault any moisture that may have found its way into the cable at the faulty place can be removed by pumping dried air through the cable. The looseness of the cable is sometimes guaranteed by specifying that air at a certain pressure (say 2 atmospheres) applied to one end of a length of cable shall reach the other end within a certain time.

On the other hand, the cables of some telephone systems are filled with wax compound for a short distance on each end, so that each length of cable is sealed.

The mechanical protection applied to telephone cable depends upon the method of laying adopted; thus, plain lead-sheathed cables are used for suspended aerial systems, and also for duct and pipe systems where only one cable, or at most two, are drawn into one duct or pipe. When several cables are to be drawn into one duct, the lead-covered cable is generally protected by a layer of segmental strip armour of steel applied on a bedding of jute; the armouring can be of the open or closed type, the number of strips used for open

armour being usually half the number that would close armour the cable. For telephone cables to be laid direct into the ground, the steel-strip armour should be protected by a serving of jute and thoroughly compounded.

Diameter of Ordinary Twin Cables.

Let D = diameter of cable under the lead sheath
p = diameter of one pair of insulated wires
l = number of layers in the strand
$x\,(p)$ = diameter of the strand basis

therefore, as each layer of pairs increases the diameter by $2\,p$, it follows that

$$D = xp + 2\,pl = p\,(x + 2\,l).$$

The value of the coefficient x for various strand bases is given in Table No. 78.

Table No. 78.—Diameter of Strand Centres.

Strand Basis—i.e. Number of Pairs in Centre	Value of Coefficient x
1	1·0
2	1·6
3	2·155
4	2·414
5	2·7
6	3·0

Table No. 79 gives the number of pairs in the successive layers for the construction of various cables, also the diameter coefficient or value of $(x + 2\,l)$.

TABLE No. 79.—TELEPHONE CABLE CONSTRUCTION.

No. of Pairs	Diam. coefficient	Centre	Number of Pairs in Successive Layers																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
2	1·6	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	2·155	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	2·414	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	3·0	1	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	2·7	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	3·0	1	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	3·0	1	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	3·6	2	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	4·155	3	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	4·414	4	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	4·414	4	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	4·7	5	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	4·7	5	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	5·0	1	6	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	5·6	2	6	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	5·6	2	7	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	5·6	2	8	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	6·155	3	8	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	6·155	3	9	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	6·155	3	9	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	6·155	3	9	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	6·155	3	9	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	6·414	4	10	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
33	6·7	5	11	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37	7·0	1	6	12	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
42	7·6	2	8	13	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..
44	7·6	2	8	14	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	8·155	3	9	15	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	8·155	3	9	16	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	8·414	4	10	16	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	8·414	4	10	16	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	8·7	5	11	17	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	9·0	1	6	12	18	24	..	..	..	..	..	..	..	..	..	..	..	..	..
62	9·0	1	6	12	18	25	..	..	..	..	..	..	..	..	..	..	..	..	..
70	9·6	2	8	14	20	26	..	..	..	..	..	..	..	..	..	..	..	..	..
75	10·155	3	9	15	21	27	..	..	..	..	..	..	..	..	..	..	..	..	..
75	10·414	4	10	15	20	26	..	..	..	..	..	..	..	..	..	..	..	..	..
77	10·155	3	9	15	22	28	..	..	..	..	..	..	..	..	..	..	..	..	..
77	10·414	4	10	15	21	27	..	..	..	..	..	..	..	..	..	..	..	..	..
80	10·414	4	10	16	22	28	..	..	..	..	..	..	..	..	..	..	..	..	..
84	10·7	5	11	17	23	28	..	..	..	..	..	..	..	..	..	..	..	..	..
85	10·7	5	11	17	23	29	..	..	..	..	..	..	..	..	..	..	..	..	..
91	11·0	1	6	12	18	24	30	..	..	..	..	..	..	..	..	..	..	..	..
92	11·0	1	6	12	18	25	30	..	..	..	..	..	..	..	..	..	..	..	..
100	11·6	2	7	13	19	26	33	..	..	..	..	..	..	..	..	..	..	..	..
100	12·155	3	9	13	19	25	31	..	..	..	..	..	..	..	..	..	..	..	..

TABLE No. 79.—TELEPHONE CABLE CONSTRUCTION *continued.*

No. of Pairs	Diam. coefficient	Centre	Number of Pairs in Successive Layers																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
102	11·6	2	8	14	20	26	32	..	..	..	..	..	..	..	..	..	..	..	..
108	12·155	3	9	15	21	27	33	..	..	..	..	..	..	..	..	..	..	..	..
112	12·414	4	10	16	22	27	30	..	..	..	..	..	..	..	..	..	..	..	..
114	12·414	4	10	16	22	28	34	..	..	..	..	..	..	..	..	..	..	..	..
120	12·7	5	11	17	23	29	35	..	..	..	..	..	..	..	..	..	..	..	..
120	13·0	1	6	11	17	23	28	34	..	..	..	..	..	..	..	..	..	..	..
127	13·0	1	6	12	18	24	30	36	..	..	..	..	..	..	..	..	..	..	..
128	13·0	1	6	12	18	24	30	37	..	..	..	..	..	..	..	..	..	..	..
129	13·0	1	6	12	18	24	31	37	..	..	..	..	..	..	..	..	..	..	..
140	13·6	2	8	14	20	26	32	38	..	..	..	..	..	..	..	..	..	..	..
147	14·155	3	9	15	21	27	33	39	..	..	..	..	..	..	..	..	..	..	..
150	14·155	3	9	15	21	27	34	41	..	..	..	..	..	..	..	..	..	..	..
150	14·414	4	10	16	21	27	33	39	..	..	..	..	..	..	..	..	..	..	..
153	14·414	4	10	16	22	28	34	39	..	..	..	..	..	..	..	..	..	..	..
153	14·7	5	11	16	21	27	33	40	..	..	..	..	..	..	..	..	..	..	..
154	14·414	4	10	16	22	28	34	40	..	..	..	..	..	..	..	..	..	..	..
161	14·7	5	11	17	23	29	35	41	..	..	..	..	..	..	..	..	..	..	..
168	15·0	1	6	12	18	24	30	36	41	..	..	..	..	..	..	..	..	..	..
169	15·0	1	6	12	18	24	30	36	42	..	..	..	..	..	..	..	..	..	..
170	15·0	1	6	12	18	24	30	36	43	..	..	..	..	..	..	..	..	..	..
171	15·0	1	6	12	18	24	30	37	43	..	..	..	..	..	..	..	..	..	..
179	15·0	1	6	12	18	25	32	39	46	..	..	..	..	..	..	..	..	..	..
184	15·6	2	8	14	20	26	32	38	44	..	..	..	..	..	..	..	..	..	..
192	16·155	3	9	15	21	27	33	39	45	..	..	..	..	..	..	..	..	..	..
200	16·414	4	10	16	22	28	34	40	46	..	..	..	..	..	..	..	..	..	..
204	16·414	4	10	16	22	28	34	41	49	..	..	..	..	..	..	..	..	..	..
204	16·7	5	11	17	23	28	34	40	46	..	..	..	..	..	..	..	..	..	..
208	16·7	5	11	17	23	29	35	41	47	..	..	..	..	..	..	..	..	..	..
217	17·0	1	6	12	18	24	30	36	42	48	..	..	..	..	..	..	..	..	..
218	17·0	1	6	12	18	24	30	36	42	49	..	..	..	..	..	..	..	..	..
219	17·0	1	6	12	18	24	30	36	43	49	..	..	..	..	..	..	..	..	..
224	17·6	2	7	13	19	25	31	37	42	48	..	..	..	..	..	..	..	..	..
234	17·6	2	8	14	20	26	32	38	44	50	..	..	..	..	..	..	..	..	..
243	18·155	3	9	15	21	27	33	39	45	51	..	..	..	..	..	..	..	..	..
250	18·155	3	9	15	21	27	34	40	47	54	..	..	..	..	..	..	..	..	..
250	18·414	4	10	16	21	27	34	40	46	52	..	..	..	..	..	..	..	..	..
252	18·414	4	10	16	22	28	34	40	46	52	..	..	..	..	..	..	..	..	..
255	18·414	4	10	16	22	28	34	40	47	54	..	..	..	..	..	..	..	..	..
255	18·7	5	11	17	22	28	34	40	46	52	..	..	..	..	..	..	..	..	..
261	18·7	5	11	17	23	29	35	41	47	53	..	..	..	..	..	..	..	..	..
271	19·0	1	6	12	18	24	30	36	42	48	54	..	..	..	..	..	..	..	..
272	19·0	1	6	12	18	24	30	36	42	48	55	..	..	..	..	..	..	..	..
290	19·6	2	8	14	20	26	32	38	44	50	56	..	..	..	..	..	..	..	..
300	20·155	3	9	15	21	27	33	39	45	51	57	..	..	..	..	..	..	..	..
300	20·155	3	9	14	20	26	32	38	46	52	60	..	..	..	..	..	..	..	..
306	20·155	3	9	15	21	28	34	40	46	52	58	..	..	..	..	..	..	..	..

TABLE NO. 79.—TELEPHONE CABLE CONSTRUCTION—*continued.*

No. of Pairs	Diam. coefficient	Centre	Number of Pairs in Successive Layers 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
306	20·7	5	10	15	20	26	32	39	46	53	60	..	..	..	..	..	..	..	..
310	20·414	4	10	16	22	28	34	40	46	52	58	..	..	..	..	..	..	..	..
320	20·7	5	11	17	23	29	35	41	47	53	59	..	..	..	..	..	..	..	..
331	21·0	1	6	12	18	24	30	36	42	48	54	60	..	..	..	..	..	..	..
333	21·0	1	6	12	18	24	30	36	42	48	55	61	..	..	..	..	..	..	..
350	21·0	1	7	14	20	26	32	38	44	50	56	62	..	..	..	..	..	..	..
352	21·6	2	8	14	20	26	32	38	44	50	56	62	..	..	..	..	..	..	..
363	22·155	3	9	15	21	27	33	39	45	51	57	63	..	..	..	..	..	..	..
374	22·414	4	10	16	22	28	34	40	46	52	58	64	..	..	..	..	..	..	..
385	22·7	5	11	17	23	29	35	41	47	53	59	65	..	..	..	..	..	..	..
397	23 0	1	6	12	18	24	30	36	42	48	54	60	66	..	..	..	..	..	..
400	23·0	1	6	12	18	24	30	36	42	48	54	61	68	..	..	..	..	..	..
403	23·0	1	6	12	18	24	30	36	42	48	55	62	69	..	..	..	..	..	..
420	23·6	2	8	14	20	26	32	38	44	50	56	62	68	..	..	..	..	..	..
432	24·155	3	9	15	21	27	33	39	45	51	57	63	69	..	..	..	..	..	..
444	24·414	4	10	16	22	28	34	40	46	52	58	64	70	..	..	..	..	..	..
450	24·414	4	10	16	22	28	34	40	46	52	59	66	73	..	..	..	..	..	..
456	24·7	5	11	17	23	29	35	41	47	53	59	65	71	..	..	..	..	..	..
469	25·0	1	6	12	18	24	30	36	42	48	54	60	66	72	..	..	..	..	..
494	25·6	2	8	14	20	26	32	38	44	50	56	62	68	74	..	..	..	..	..
500	25·6	2	8	14	20	26	32	38	44	50	56	63	70	77	..	..	..	..	..
500	25·6	2	8	14	20	26	32	38	45	51	57	63	69	75	..	..	..	..	..
507	26·155	3	9	15	21	27	33	39	45	51	57	63	69	75	..	..	..	..	..
520	26·414	4	10	16	22	28	34	40	46	52	58	64	70	76	..	..	..	..	..
533	26·7	5	11	17	23	29	35	41	47	53	59	65	71	77	..	..	..	..	..
547	27·0	1	6	12	18	24	30	36	42	48	54	60	66	72	78	..	..	..	..
550	27·0	1	6	12	18	24	30	36	42	48	54	60	66	73	80	..	..	..	..
574	27·6	2	8	14	20	26	32	38	44	50	56	62	68	74	80	..	..	..	..
588	28·155	3	9	15	21	27	33	39	45	51	57	63	69	75	81	..	..	..	..
600	28 155	3	9	16	22	28	34	40	46	52	58	64	70	76	82	..	..	..	..
600	28·414	4	10	16	22	28	34	40	46	52	58	64	70	75	81	..	..	..	..
602	28·414	4	10	16	22	28	34	40	46	52	58	64	70	76	82	..	..	..	..
604	28·414	4	10	16	22	28	34	40	46	52	58	64	70	75	85	..	..	..	..
616	28·7	5	11	17	23	29	35	41	47	53	59	65	71	77	83	..	..	..	..
631	29·0	1	6	12	18	24	30	36	42	48	54	60	66	72	78	84	..	..	..
660	29·6	2	8	14	20	26	32	38	44	50	56	62	68	74	80	86	..	..	..
675	30·155	3	9	15	21	27	33	39	45	51	57	63	69	75	81	87	..	..	..
690	30·414	4	10	16	22	28	34	40	46	52	58	64	70	76	82	88	..	..	..
705	30·7	5	11	17	23	29	35	41	47	53	59	65	71	77	83	89	..	..	..
784	32·414	4	10	16	22	28	34	40	46	52	58	64	70	76	82	88	94	..	..
800	32·414	4	10	16	22	28	34	40	46	52	58	64	71	78	85	92	100	..	..
800	32·7	5	11	17	23	29	35	41	47	53	59	65	71	77	83	89	95	..	..
804	32·7	5	11	17	23	29	35	41	47	53	59	65	71	77	83	89	99	..	..
900	34·414	4	10	16	22	28	34	40	46	52	58	64	70	77	84	91	98	106	..
1000	36·414	4	10	16	22	28	34	40	46	52	58	64	70	77	83	89	96	103	110

RELATION BETWEEN NUMBER OF WIRES AND DIAMETER OF CABLE.

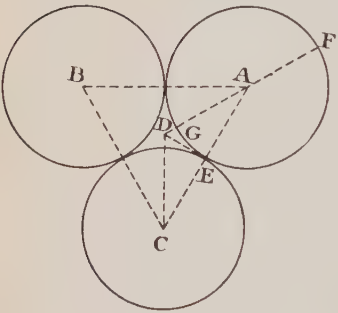


FIG. 6.

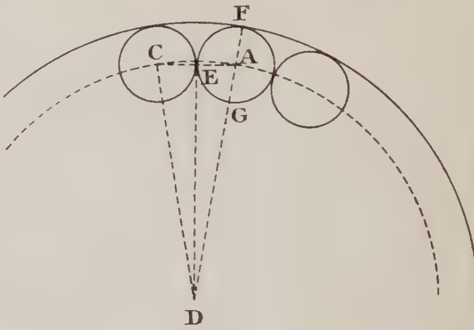


FIG. 7.

In the case of a ring formed of n wires of equal diameter d, by joining up the centres of the wires a regular polygon of n sides is formed, and the angle at the centre of the system subtended by any one wire is $\frac{360^\circ}{n}$. In any such figure (Figs. 6 and 7)

$$\mathrm{A\,C} = d = 2\,\mathrm{A\,E};$$

$$\therefore \quad \text{the angle } \mathrm{A\,D\,E} = \frac{180^\circ}{n};$$

$$\therefore \quad \frac{\mathrm{A\,D}}{\mathrm{A\,E}} = \operatorname{cosec}\frac{180^\circ}{n}; \qquad \therefore \quad \mathrm{A\,D} = \frac{d}{2}\operatorname{cosec}\frac{180^\circ}{n}.$$

Let D_o be the diameter over the layer of wires,
D_i be the diameter under the layer of wires;

$$\therefore \quad D_o = 2\,\mathrm{D\,F} = 2\,\mathrm{A\,D} + d = d\left(\operatorname{cosec}\frac{180^\circ}{n} + 1\right)$$

and

$$D_i = 2\,\mathrm{D\,F} - 2d = d\left(\operatorname{cosec}\frac{180^\circ}{n} - 1\right).$$

Therefore the number of wires (n) of equal diameter (d) which can be placed in one layer round a cylinder of diameter D_i is given by

$$D_i = d\left(\operatorname{cosec}\frac{180^\circ}{n} - 1\right),$$

and the number of wires (n) of equal diameter (d) which can be placed around the inside of a cylinder of diameter D_o is given by

$$D_o = d\left(\operatorname{cosec}\frac{180^\circ}{n} + 1\right).$$

When the number of wires (n) becomes large, the sine of the angle A D E is approximately equal to the angle itself, for

$$\sin \mathrm{A\,D\,E} = \frac{\mathrm{A\,E}}{\mathrm{A\,D}} \quad \text{and} \quad \text{angle } \mathrm{A\,D\,E} = \frac{\text{chord } \mathrm{A\,E}}{\mathrm{A\,D}}.$$

$$\text{But the chord } \mathrm{A\,E} = \frac{\pi\,(\mathrm{D}_o - d)}{2\,n}, \quad \text{and} \quad \mathrm{A\,D} = \frac{\mathrm{D}_o - d}{2};$$

$$\therefore \quad \operatorname{cosec} \mathrm{A\,D\,E} = \operatorname{cosec} \frac{180^\circ}{n} = \frac{(\mathrm{D}_o - d)\,2\,n}{2\,\pi\,(\mathrm{D}_o - d)} \text{ (approximately)};$$

$$\therefore \quad \mathrm{D}_o = d\left(\frac{n}{\pi} + 1\right);$$

$$\therefore \quad n = \frac{\pi\,(\mathrm{D}_o - d)}{d} = \frac{3\,(\mathrm{D}_o - d)}{d} \text{ (approximately)}$$

Every layer of wires increases D_o by $2\,d$; therefore the increase in the number of wires per layer is

$$\frac{3 \cdot 14\,(2\,d)}{d} = 6 \cdot 24;$$

that is, 6 wires per layer.

In telephone cables, when the number of pairs of wires reaches 40 or 50 per layer, it is found in practice that an increase per layer of 7 or even 8 pairs of wires is possible.

For the construction of telephone cables it is necessary to know (1) the size of each conductor; (2) the number of pairs of conductors; (3) the wire-to-wire electrostatic capacity of the conductors; and (4) the diameter of the cable.

Generally speaking, the size of the conductor, the number of pairs of conductors, and the wire-to-wire electrostatic capacity, are given, and it is required to determine the minimum diameter of cable.

Let d = diameter of each conductor in mm.
n = number of pairs of conductors
c = wire-to-wire electrostatic capacity in microfarads per km.
D = diameter of cable under the lead sheath in mm.
p = diameter of one insulated pair of conductors in mm.
l = number of layers of pairs in the cable
x = strand basis coefficient.

Let d, n, and c be given; required to find D.

Table No. 79 gives the value of D in terms of p; thus, a cable of 500 pairs would be constructed by stranding 12 layers of pairs round a basis of 2 pairs; therefore

$$\mathrm{D} = p\,(x + 2\,l) = p\,(1 \cdot 6 + 24) = 25 \cdot 6\,p;$$

therefore it is required to determine the diameter p of one pair of insulated conductors, so that the wire-to-wire electrostatic capacity of the pair will be less than c microfarads per kilometre. The capacity of two cylinders of radii r_1 and r_2 lying parallel to each other, the distance apart a being great as compared with their radii, is equal to

$$\frac{1}{2 \log_e \dfrac{a^2}{r_1 r_2}} \text{ electrostatic units per. cm. of length.}$$

$$= \frac{1}{4 \cdot 6 \log_{10} \dfrac{a^2}{r_1 r_2}} \cdot \frac{10^5}{9 \times 10^5} \text{ microfarads for kilometre.}$$

$$= \frac{0 \cdot 02416}{\log_{10} \dfrac{a^2}{r_1 r_2}} \text{ microfarads per kilometre.}$$

Therefore the wire-to-wire capacity of equal conductors twinned together will be approximately

$$\frac{0 \cdot 02416\, k}{\log_{10} \dfrac{a^2}{r^2}}$$

where k is the dielectric constant of the insulating material; its value for paper is approximately $2 \cdot 0$, and for paper and air space cables $1 \cdot 7$ to $1 \cdot 9$.

The value of a, that is, the distance between the centres of the conductors, depends upon the twinning operation, for the conductors are pulled nearer together the greater the friction on the bobbins of the twinning machine, and can therefore only be estimated; its maximum value will be equal to the diameter of the insulated conductor. If therefore, the value of the equivalent diameter b of an insulated conductor be inserted in the formula

$$\frac{0 \cdot 02416\; k}{\log_{10} \dfrac{a^2}{r^2}} = \text{microfarads per kilometre,}$$

in place of the value a we obtain the approximate equation

$$\frac{0 \cdot 02416\; (k\, x)}{\log_{10} \dfrac{b^2}{r^2}} = \text{microfarads per kilometre,}$$

or

$$\frac{0 \cdot 01208\; (k\, x)}{\log_{10} \dfrac{b}{r}} = \text{microfarads per kilometre;}$$

where b, the equivalent diameter of the core, is equal to $\dfrac{p}{\sqrt{2}}$. The factor $(k\, x)$ can be treated as a constant, and its value determined from actual cables. For example:—153 pair telephone cable, with 20 lb. conductors insulated with one paper, diameter over lead = $59 \cdot 6$ mm., thickness of lead $3 \cdot 6$ mm., wire-to-wire capacity = $0 \cdot 0334$ microfarad per kilometre.

Table No. 79 gives the construction 6 layers of pairs round a centre of 4 pairs, therefore the diameter coefficient is $14 \cdot 414$.

Diameter under lead sheath = $59 \cdot 6 - 2\,(3 \cdot 6) = 52 \cdot 4$ mm.

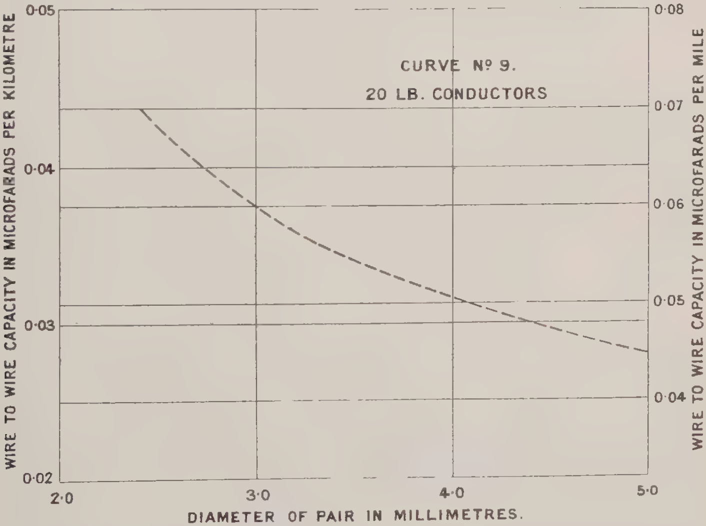
$$\therefore \qquad \text{Diameter of pair} = \frac{52 \cdot 4}{14 \cdot 414} = 3 \cdot 63 \text{ mm.}$$

$$\therefore \text{ Equivalent diameter of one core} = \frac{3 \cdot 63}{\sqrt{2}} = 2 \cdot 568 \text{ mm.}$$

$$\therefore \qquad (k\,x) = \frac{\text{microfarads per kilometre} \times \log_{10} \frac{b}{r}}{0 \cdot 01208}$$

$$= \frac{0 \cdot 0334 \times \log_{10} \frac{2 \cdot 568}{0 \cdot 457}}{0 \cdot 01208} = 2 \cdot 07$$

which agrees fairly closely with the value of the dielectric constant k of 1·7 to 1·9.



This constant $(k\,x)$ can now be used to determine, within limits, the variation of the wire-to-wire capacity with the diameter of the pair for 20 lb. conductors, as shown in Table No. 80 and Curve No. 9.

The constant $k\,x$ is found to vary somewhat with the size of the conductor and with the number of pairs of conductors in the cable. Table No. 81 gives the safe value of $k\,x$ for various telephone cables, the figures being deduced from tests on over 500 telephone cables.

Suppose it is required to construct a telephone cable to consist of 600 pairs of conductors, each 0·5 mm. in diameter, to have a wire-to-wire capacity of 0·039 microfarads per kilometre (0·0627 microfarads per mile).

Table No. 80.—Relation between Wire-to-Wire Capacity and Diameter of Insulated Pair for 153-Pair Cable of 20 lb. Conductors.

Calculated from the equation :—

$$\frac{0 \cdot 01208 \times 2 \cdot 07}{\log_{10} \frac{b}{r}} = \text{microfarads per kilometre.}$$

Diam. of Pair in mm.	Equivalent Diam. of Core in mm.	$\text{Log}_{10} \frac{b}{r}$	Wire-to-Wire Capacity	
			Per kilometre	Per mile
2·5	1·767	0·5877	0·0426	0·0685
3·0	2·120	0·6674	0·0375	0·0602
3·5	2·480	0·7356	0·0340	0·0546
4·0	2·830	0·7924	0·0316	0·0508
4·5	3·180	0·8432	0·0297	0·0476
5·0	3·540	0·8899	0·0281	0·0451

The value of the constant $k x$ for 600 pairs of 0·5 mm. diameter conductor is given in the table as 2·42; therefore the equivalent diameter of a single insulated conductor will be given by the equation :—

$$\log_{10} \frac{b}{r} = \frac{0 \cdot 01208 \, (k \, x)}{\text{mfds. per kilometre}} = \frac{0 \cdot 01208 \times 2 \cdot 42}{0 \cdot 039}$$

$$\therefore \quad \log_{10} b - \log_{10} 0 \cdot 25 = 0 \cdot 75$$

$$\therefore \quad b = 1 \cdot 406 \text{ mm.}$$

Table No. 81.—Value of $k x$ for Telephone Cables.

Conductor			Number of Pairs in Cable									
Diam. mm.	Diam. mils	Lb. per mile	50	100	200	300	400	500	600	800	900	1000
0·4	15·75	3·98	2·30	2·30	..	..	..	..	..	..	..	..
0·5	19·7	6·21	..	..	2·40	2·40	2·40	2·42	2·42	2·42	2·42	2·45
0·6	23·6	8·94	..	..	2·15	2·20	2·30	2·40	2·50	2·50	..	..
0·635	25·0	10·0	1·90	1·90	1·92	1·97	2·10	2·20	2·40	2·40	..	..
0·7	27·6	12·16	2·06	2·06	2·06	2·06	2·15	2·20	..	..	..	..
0·711	28·0	12·5	2·04	2·01	2·00	2·04	2·13	2·20	..	..	..	..
0·8	31·5	15·9	2·09	2·09	2·14	2·20	2·28	..	..	..	..	..
0·91	35·5	20·0	2·06	2·00	2·05	2·15	2·20	..	..	..	..	..
1·0	39·4	24·8	2·06	2·00	2·08	..	..	..	..	..	..	..
1·27	50·0	40·0	2·03	2·00	2·10	..	..	..	..	..	..	..
1·676	66	70	2·00	2·00	..	..	..	..	..	..	..	..
2·006	79	100	2·20	2·17	..	..	..	..	..	..	..	..
2·46	97	150	2·20	..	..	..	..	..	..	..	..	..
2·84	112	200	2·17	..	..	..	..	..	..	..	..	..

Therefore, the diameter of the insulated pair will be

$$1 \cdot 406 \sqrt{2} = 1 \cdot 988, \text{ or, roundly, } 2 \cdot 0 \text{ mm.}$$

The diameter coefficient for a 600-pair cable is found from the table to be 28·155, and the construction would be 13 layers over a centre of 3 pairs, the layers consisting of 9, 16, 22, 28, 34, 40, 46, 52, 58, 64, 70, 76, and 82 pairs respectively. Therefore, the diameter of the cable under the lead sheath would be

$$28 \cdot 155 \times 2 \cdot 0 = 56 \cdot 31 \text{ mm.}$$

Width of Paper.

If b = the equivalent diameter of an insulated core, then πb = the circumference of the core; if the paper be longitudinally applied and an allowance of 10 per cent. overlap be made, the width of the paper will be (πb + 10 per cent.).

If the paper be spirally lapped, then the width of paper necessary to form a closed helix is given by B D in fig. No. 8, where A B is equal to the circumference πb of the core and B C is equal to the length of lay of the paper, B D being perpendicular to A C.

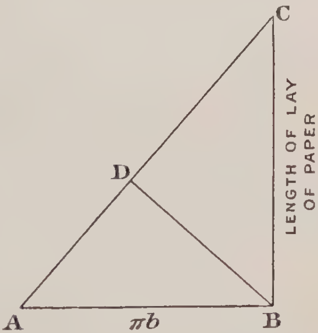


Fig. 8.

The necessary overlap must be added to the width B D. The approximate width of the paper necessary is given by 10 times the diameter of the conductor plus 10 per cent.; thus, for 0·8 millimetre conductors the paper should have a width of (10 × 0·8) + 10 per cent. = 8·8 mm.

The specific gravity of the paper used for insulating telephone conductors is approximately 0·85; as, however, the weight of the paper is generally calculated from the thickness, which varies somewhat, it is usual to assume a specific gravity of 1·0. If the paper is applied to the conductor longitudinally, its weight in kilogrammes per kilometre per layer of paper is equal to :—

(width of paper in millimetres × thickness of paper in millimetres),

or, in lb. per statute mile :—

(width in millimetres × thickness in millimetres) 3·55.

The weight of the thread whipping averages one-tenth of the weight of the paper.

An increase of 1 per cent. in the weights is allowed for the lay of the individual insulated wires in pairing, and a further 2 per cent. for the stranding together of the pairs.

If the paper be spirally lapped on to the conductor, its weight is approximately equal to :—

$\pi d t$ + 20 per cent. = ($3 \cdot 77\, d\, t$) kilogrammes per kilometre,

or, ($13 \cdot 4\, d\, t$) lb. per statute mile,

where d = diameter of the insulated conductor in millimetres,

and t = thickness of the paper in millimetres.

The layer of paper over the laid-up pairs increases the diameter of the cable by 0·5 mm. A layer of calico tape sometimes applied to the cable directly under the lead sheath also increases the diameter of the cable by 0·5 mm.

The approximate price of telephone paper is 80*s.* per 100 kilogrammes (36·4*s.* per 100 lb.), and of the whipping (hemp netting) 350*s.* per 100 kilogrammes (159*s.* per 100 lb.).

Dielectric Resistance.—It is usual to specify a minimum dielectric resistance of 5000 megohms per mile, measured with a battery voltage; very much higher resistance is easily obtainable.

Table No. 82 shows the variation of the dielectric resistance with the temperature.

The dielectric resistance when measured with high-frequency voltage is very much less than that obtained when testing with a battery. According to Béla Gáti, a cable consisting of a few pairs of conductors insulated with paper and air space has a dielectric resistance of approximately one-third of a megohm, and a cable of many pairs only one-tenth of a megohm when tested with a voltage of 1000 periods per second.

The *Dielectric Constant* for paper and air-space cables varies between 1·7 and 1·9.

Table No. 83 shows the variation of the electrostatic capacity of a paper and air-space cable with the temperature.

Table No. 82.—Temperature Coefficients for the Dielectric Resistance of Paper Telephone Cables.

The dielectric resistance of a cable at 15° C. is equal to the dielectric resistance at t° C. multiplied by the coefficient for t° C.

t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient
− 10	0·436	0·5	0·584	11·0	0·841	21·5	1·403	32·0	2·740
− 9·5	·442	1·0	·5925	11·5	·859	22·0	1·445	32·5	2·840
− 9·0	·447	1·5	·6025	12·0	·8775	22·5	1·490	33·0	2·930
− 8·5	·453	2·0	·609	12·5	·895	23·0	1·535	33·5	3·025
− 8·0	·459	2·5	·622	13·0	·914	23·5	1·583	34·0	3·135
− 7·5	·464	3·0	·6325	13·5	·933	24·0	1·633	34·5	3·230
− 7·0	·470	3·5	·645	14·0	·954	24·5	1·688	35·0	3·340
− 6·5	·477	4·0	·6535	14·5	·975	25·0	1·741	35·5	3·440
− 6·0	·484	4·5	·665	15·0	1·000	25·0	1·796	36·0	3·565
− 5·5	·490	5·0	·676	15·5	1·022	26·0	1·850	36·5	3·670
− 5·0	·496	5·5	·688	16·0	1·047	26·5	1·920	37·0	3·810
− 4·5	·504	6·0	·700	16·5	1·073	27·0	1·975	37·5	3·940
− 4·0	·511	6·5	·711	17·0	1·100	27·5	2·040	38·0	4·060
− 3·5	·518	7·0	·717	17·5	1·129	28·0	2·105	38·5	4·21
− 3·0	·526	7·5	·7365	18·0	1·159	28·5	2·180	39·0	4·34
− 2·5	·534	8·0	·752	18·5	1·186	29·0	2·245	39·5	4·49
− 2·0	·542	8·5	·766	19·0	1·222	29·5	2·325	40·0	4·63
− 1·5	·549	9·0	·7815	19·5	1·255	30·0	2·400	..	..
− 1·0	·558	9·5	·7955	20·0	1·290	30·5	2·488	..	..
− 0·5	·5645	10·0	·810	20·5	1·326	31·0	2·570	..	..
0	·575	10·5	·8255	21·0	1·362	31·5	2·660	..	..

Table No 83.—Temperature Coefficients for the Electrostatic Capacity of Paper Telephone Cables.

The capacity of a cable at 15° C. is equal to the capacity at t° C. multiplied by the coefficient for t° C.

t° C.	Coefficient	t° C.	Coefficient	t° C.	Coefficient
− 10	1·0290	7	1·0090	24	0·9900
− 9	1·0275	8	1·0085	25	0·9890
− 8	1·0260	9	1·0065	26	0·9878
− 7	1·0250	10	1·0055	27	0·9865
− 6	1·0235	11	1·0040	28	0·9852
− 5	1·0225	12	1·0028	29	0·9840
− 4	1·0210	13	1·0015	30	0·9822
− 3	1·0200	14	1·0005	31	0·9810
− 2	1·0190	15	1·0000	32	0·9798
− 1	1·0180	16	0·999	33	0·9790
0	1·0165	17	0·998	34	0·9780
1	1·0155	18	0·9965	35	0·9762
2	1·0150	19	0·995	36	0·9750
3	1·0130	20	0·994	37	0·9740
4	1·0120	21	0·993	38	0·9725
5	1·0100	22	0·9918	39	0·9705
6	1·0095	23	0·9905	40	0·9692

CHAPTER VI.

VULCANISED BITUMEN.

Bitumen compound, as used in the manufacture of electric cables, is generally composed of refined Trinidad bitumen and elastic or cotton-seed pitch in about equal proportions, to which is added from 5 to 10 per cent. of sulphur, in order to effect vulcanisation.

Bitumen compound is used either as an insulating material, or as a waterproof protection to paper, jute, or rubber insulated cables.

As an insulator, the bitumen is either applied directly to the tinned conductor, or the conductor (of plain copper) is first lapped with a thin separating layer of impregnated paper or jute, on to which the bitumen is applied; in either case the insulated conductor is lapped with a bitumen-impregnated tape, and finally braided with jute, or armoured with steel wires.

As a waterproof sheath, bitumen is applied directly on to the paper insulated, jute insulated, or taped rubber-insulated conductor, instead of the more usual sheathing of lead.

There are two general methods of applying the bitumen to the cable, viz. lapping and forcing; application of the bitumen by the longitudinal machine also gives good results for smaller cables.

Lapping Method.—The bitumen, in the form of a tape, is spirally lapped on to the cable with an overlap equal to one half the width of the tape; the insulated cable is next taped with a bitumen-impregnated tape, and the whole vulcanised for 1 to 2 hours at approximately 35 lb. steam pressure.

Forcing Method.—This method is more extensively used than the lapping method. The bitumen compound is first vulcanised in small pans for several hours at a moderately high steam pressure, and then calendered into thick tapes, suitable for feeding into the forcing machine.

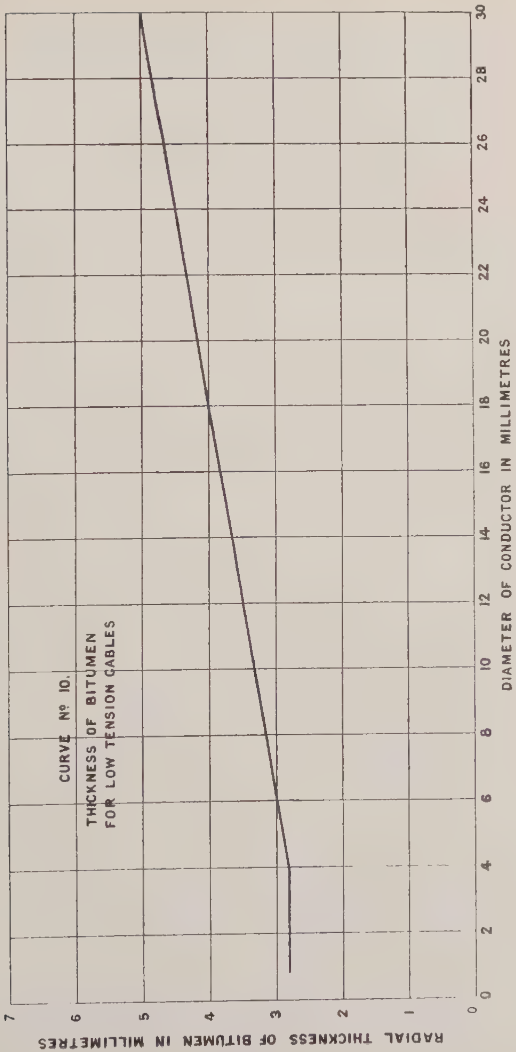
The conductor, bare, or insulated with the paper or jute separator, is fed through the forcing machine, and covered with bitumen to the necessary thickness by means of a suitable die.

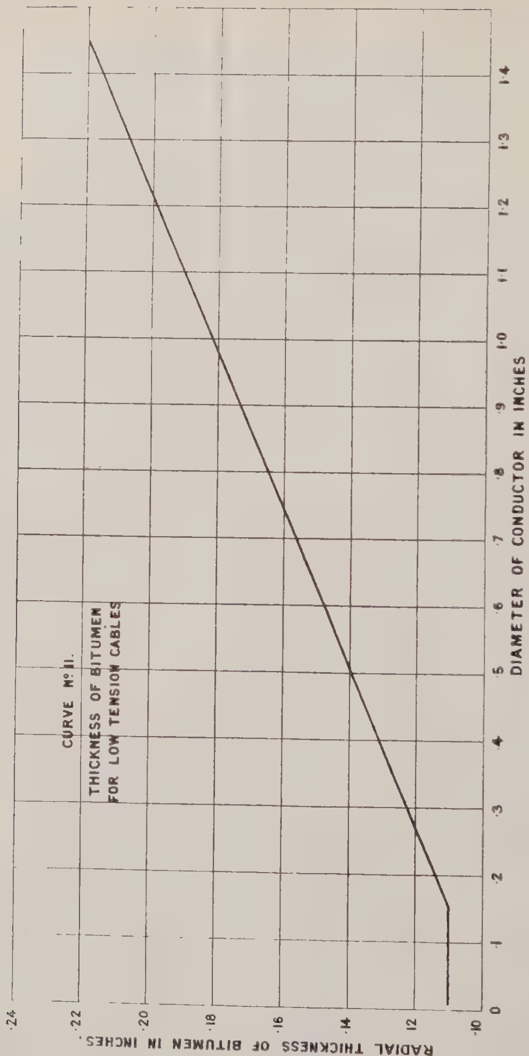
The bitumen-covered cable is immediately passed through a cooling tank containing cold water, and then lapped with bitumen-impregnated tape.

Three-core solid bitumen cables, largely used for mining work, are manufactured with a triangular-shaped centre core of bitumen, on which the three bitumen insulated conductors are stranded, the whole being next passed through a forcing machine, which applies the outer covering, ribbed internally to exactly fit the stranded cores.

For bitumen-insulated cables, it is necessary to run the conductor strand through hot bitumen compound, in order to fill up the interstices and prevent the passage of any water down the conductor.

Thickness of Bitumen.—(i) *As dielectric.* The thickness of bitumen is generally taken as 150 to 200 per cent. of the corresponding paper thickness, with 100 mils as a minimum. When a paper or jute separator is used, its radial thickness is usually 1 mm. (40 mils), this thickness being quite sufficient for all ordinary cases.


CURVE Nº 10.
THICKNESS OF BITUMEN
FOR LOW TENSION CABLES
DIAMETER OF CONDUCTOR IN MILLIMETRES
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
RADIAL THICKNESS OF BITUMEN IN MILLIMETRES
0 1 2 3 4 5 6 7


CURVE Nº 11.
THICKNESS OF BITUMEN
FOR LOW TENSION CABLES
DIAMETER OF CONDUCTOR IN INCHES
0
·1
·2
·3
·4
·5
·6
·7
·8
·9
1·0
1·1
1·2
1·3
1·4
RADIAL THICKNESS OF BITUMEN IN INCHES.
·10
·12
·14
·16
·18
·20
·22
·24

Curves Nos. 10 and 11 give the thickness of bitumen for various diameters of conductors, according to the average practice.

(ii) *As waterproof sheath.* The thickness of bitumen is generally taken as 150 to 200 per cent. of the corresponding lead thickness, with 100 mils as a minimum.

Weight of Bitumen.—The specific gravity of bitumen compound varies between 1·20 and 1·30; the value 1·25 being a safe average.

The weight of bitumen is, therefore, equal to

$$\frac{\pi}{4}(D^2 - c\,d^2)\,1 \cdot 25 = 0 \cdot 982\,(D^2 - c\,d^2) \text{ kilog. per km.,}$$

where

D = diameter over the bitumen in millimetres.
d = diameter over the conductor in millimetres.
c = a constant, depending upon the number of wires in the conductor strand; its value is as follows:—

For 7-wire strand	$c = 0 \cdot 8$
„ 19 „ „	$c = 0 \cdot 85$
„ 37 „ „	$c = 0 \cdot 87$
„ 61 „ „	$c = 0 \cdot 88$
„ above 61	$c = 0 \cdot 90$
„ solid conductor	$c = 1 \cdot 00$

or the weight of bitumen in lb. per statute mile is equal to

$$3 \cdot 484\,(D^2 - c\,d^2).$$

If the conductor be provided with a paper separator, then the weight of bitumen is equal to

$$0 \cdot 982\,(D^2 - d^2) \text{ kilogrammes per kilometre,}$$

or

$$3 \cdot 484\,(D^2 - d^2) \text{ lb. per statute mile,}$$

where D = diameter over bitumen in millimetres
d = diameter over the paper separator in millimetres.

In the case of a three-core solid bitumen cable the weight of bitumen is equal to

$$0 \cdot 982\,(D^2 - 3 \cdot 06\,c\,d^2) \text{ kilogrammes per kilometre,}$$

or

$$3 \cdot 484\,(D^2 - 3 \cdot 06\,c\,d^2) \text{ lb. per statute mile,}$$

where d = the diameter of the conductor in millimetres
c = the constant depending on the number of wires in the conductor strand
D = the diameter over the outside insulating bitumen in millimetres.

The factor 3·06 allows for the three conductors with 2 per cent. for lay.

The price of bitumen compound for cable manufacture varies between 60/- and 80/- per 100 kilogrammes, or 27·2/- and 36·3/- per 100 lb.

The dielectric constant of vulcanised bitumen compound is approximately 3·8.

The specific dielectric resistance of vulcanised bitumen compound varies between 200×10^7 and 100×10^7 megohms per c.c. after one minute's electrification at 60° F.

The variation of the dielectric resistance with temperature depends, of course, to a certain extent, on the composition of the vulcanised bitumen. Table No. 84 gives the coefficients for a standard mixture largely used for insulating cables.

TABLE NO. 84.—TEMPERATURE COEFFICIENTS FOR THE DIELECTRIC RESISTANCE OF VULCANISED BITUMEN.

The dielectric resistance at 60° F. is equal to the dielectric resistance at t° F., multiplied by the coefficient for t° F.

t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient	t° F.	Coefficient
40	0·399	51	0·697	62	1·085	73	1·610	84	2·41	95	3·71
41	·425	52	·727	63	1·130	74	1·675	85	2·50	96	3·87
42	·452	53	·755	64	1·170	75	1·740	86	2·59	97	4·03
43	·480	54	·787	65	1·210	76	1·810	87	2·70	98	4·21
44	·505	55	·822	66	1·245	77	1·875	88	2·80	99	4·40
45	·530	56	·852	67	1·290	78	1·940	89	2·90	100	4·60
46	·557	57	·887	68	1·335	79	2·015	90	3·03	101	4·82
47	·582	58	·922	69	1·380	80	2·090	91	3·15	102	5·04
48	·610	59	·960	70	1·436	81	2·170	92	3·28	103	5·33
49	·635	60	1·000	71	1·485	82	2·250	93	3·42	104	5·74
50	·672	61	1·044	72	1·550	83	2·330	94	3·59	105	6·05

The dielectric strength of vulcanised bitumen is approximately 14,000 volts per mm.

CHAPTER VII.

TAPES AND BRAIDS.

(A) Tapes.

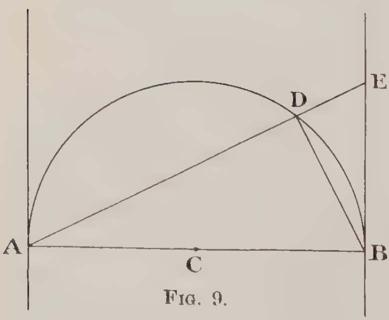


FIG. 9.

Width and Lay of Tape:—

Let d = mean diameter of tape, i.e. diameter from centre to centre of tape

W = width of tape

w = width of overlap

l = length of lay of tape

Draw A B to represent the circumference, that is equal to πd; and construct a semicircle on A B; cut off B D equal in length to $(W - w)$ and join A D and produce. Draw B E perpendicular to A B, then B E represents the length of lay of the tape and A E represents the length of tape necessary to cover a length of core equal to B E.

From the figure :—

$$\frac{BE}{BD} = \frac{AB}{AD} \qquad (BE = l \text{ and } AB = \pi d)$$

$$\therefore\ l = \text{B D} \cdot \frac{\text{A B}}{\text{A D}} = \frac{(\text{W} - w)\,\pi\, d}{\sqrt{(\pi\, d)^2 - (\text{W} - w)^2}} = \frac{1}{\sqrt{\dfrac{1}{(\text{W}-w)^2} - \dfrac{1}{(\pi\, d)^2}}}$$

and

$$\text{W} = w + \frac{1}{\sqrt{\dfrac{1}{l^2} + \dfrac{1}{(\pi\, d)^2}}}$$

Quantity of Tape required :—

Let L = length of core to be taped.
T l = length of tape required.
T a = area of tape required.

other symbols as above ; then :—

From the figure: —A E represents the length of tape required to cover core of length B E (or l). Therefore for core of L length the required length of tape will be

$$\frac{\text{A E}}{l}\,\text{L} = \frac{\text{A B.BE.L}}{\text{B D}.l} = \frac{\pi\, d.l.\text{L}}{(\text{W}-w)\, l} = \frac{\pi\, d\, \text{L}}{(\text{W}-w)}$$

or direct : area of core to be covered = $\pi\, d$ L, effective width of tape = (W $- w$).

$$\therefore\ \text{length of tape} = \frac{\pi\, d\, \text{L}}{(\text{W}-w)}$$

$$\text{area of tape required} = \frac{\pi\, d\, \text{L}\, w}{(\text{W}-w)}$$

If L is given in yards and d, W and w in inches, then

$$\text{area of tape required} = \frac{\text{W}\,\pi\, d\, \text{L}}{36\,(\text{W}-w)}\ \text{square yards.}$$

In the case of tape with half overlap, the area of tape required becomes:

$$\frac{\pi\, d\, \text{L}}{18}\ \text{sq. yards.}$$

Table No. 85 gives the surface of cylindrical cables in square yards per nautical mile (2029 yards).

The area of tape required per nautical mile of core of diameter (mean tape diameter) d mm. is equal to ;

6·971 d square yards	.. .. ..	for no overlap.
8·133 d ,, ,,	.. .. ..	,, $\frac{1}{7}$th lap.
8·366 d ,, ,,	.. .. ..	,, $\frac{1}{6}$,,
8·714 d ,, ,,	.. .. ..	,, $\frac{1}{5}$,,
9·295 d ,, ,,	.. .. ..	,, $\frac{1}{4}$,,
10·458 d ,, ,,	.. .. ..	,, $\frac{1}{3}$,,
13·942 d ,, ,,	.. .. ..	,, $\frac{1}{2}$,,

The area of tape required per kilometre of core of mean diameter d mm. (i.e. diameter over core plus one layer of tape) is equal to:

3·141 d square metres	.. .. ..	for no overlap.
3·665 d ,, ,,	.. .. ..	,, $\frac{1}{7}$th lap.
3·770 d ,, ,,	.. .. ..	,, $\frac{1}{6}$,,
3·927 d ,, ,,	.. .. ..	,, $\frac{1}{5}$,,
4·189 d ,, ,,	.. .. ..	,, $\frac{1}{4}$,,
4·713 d ,, ,,	.. .. ..	,, 1 ,,
6·283 d ,, ,,	.. .. ..	,, $\frac{1}{2}$,,

Table No. 85.—Surface of a Cable.

Diameter mm.	Diameter in.	Square Yards per Nautical Mile	Diameter mm.	Diameter in.	Square Yards per Nautical Mile
0·5	0·0197	3·4855	25·5	1·0039	177·76
1·0	·0394	6·9711	26·0	1·0236	181·25
1·5	·0591	10·456	26·5	1·0433	184·73
2·0	·0787	13·942	27·0	1·0630	188·39
2·5	·0984	17·428	27·5	1·0827	191·71
3·0	·1181	20·913	28·0	1·1024	195·19
3·5	·1378	24·399	28·5	1·1221	198·68
4·0	·1575	27·884	29·0	1·1417	202·16
4·5	·1772	31·370	29·5	1·1614	205·65
5·0	·1968	34·856	30·0	1·1811	209·13
5·5	·2165	38·341	30·5	1·2008	212·62
6·0	·2362	41·827	31·0	1·2203	216·11
6·5	·2559	45·312	31·5	1·2402	219·59
7·0	·2756	48·798	32·0	1·2599	223·08
7·5	·2953	52·283	32·5	1·2795	226·56
8·0	·3150	55·769	33·0	1·2992	230·05
8·5	·3346	59·255	33·5	1·3189	233·53
9·0	·3543	62·740	34·0	1·3386	237·02
9·5	·3740	66·226	34·5	1·3583	240·50
10·0	·3937	69·711	35·0	1·3780	243·99
10·5	·4134	73·197	35·5	1·3977	247·48
11·0	·4331	76·683	36·0	1·4173	250·96
11·5	·4528	80·168	36·5	1·4370	254·45
12·0	·4724	83·654	37·0	1·4567	257·93
12·5	·4921	87·139	37·5	1·4764	261·42
13·0	·5118	90·625	38·0	1·4961	264·90
13·5	·5315	94·110	38·5	1·5158	268·39
14·0	·5512	97·596	39·0	1·5355	271·87
14·5	·5709	101·08	39·5	1·5551	275·36
15·0	·5906	104·57	40·0	1·5748	278·85
15·5	·6102	108·05	40·5	1·5948	282·33
16·0	·6299	111·54	41·0	1·6142	285·82
16·5	·6496	115·02	41·5	1·6339	289·30
17·0	·6693	118·51	42·0	1·6536	292·79
17·5	·6890	121·99	42·5	1·6733	296·27
18·0	·7087	125·48	43·0	1·6929	299·76
18·5	·7284	128·97	43·5	1·7126	303·24
19·0	·7480	132·45	44·0	1·7323	306·73
19·5	·7677	135·94	44·5	1·7520	310·22
20·0	·7874	139·42	45·0	1·7717	313·70
20·5	·8071	142·91	45·5	1·7914	317·19
21·0	·8268	146·39	46·0	1·8111	320·67
21·5	·8465	149·88	46·5	1·8307	324·16
22·0	·8661	153·36	47·0	1·8504	327·64
22·5	·8858	156·85	47·5	1·8701	331·13
23·0	·9055	160·34	48·0	1·8898	334·61
23·5	·9252	163·82	48·5	1·9095	338·10
24·0	·9449	167·31	49·0	1·9292	341·59
24·5	·9646	170·79	49·5	1·9488	345·07
25·0	·9843	174·28	50·0	1·9685	348·56

TABLE No. 85.—SURFACE OF A CABLE—*continued.*

Diameter		Square Yards per Nautical Mile	Diameter		Square Yards per Nautical Mile
mm.	in.		mm.	in.	
50·5	1·9882	352·04	75·5	2·9725	526·32
51·0	2·0079	355·53	76·0	2·9922	529·81
51·5	2·0276	359·01	76·5	3·0119	533·29
52·0	2·0473	362·50	77·0	3·0315	536·78
52·5	2·0670	365·98	77·5	3·0512	540·26
53·0	2·0866	369·47	78·0	3·0709	543·75
53·5	2·1063	372·96	78·5	3·0906	547·24
54·0	2·1260	376·44	79·0	3·1103	550·72
54·5	2·1457	379·93	79·5	3·1300	554·21
55·0	2·1654	383·41	80·0	3·1497	557·69
55·5	2·1851	386·90	80·5	3·1693	561·18
56·0	2·2048	390·38	81·0	3·1890	564·66
56·5	2·2244	393·87	81·5	3·2087	568·15
57·0	2·2441	397·35	82·0	3·2284	571·63
57·5	2·2638	400·84	82·5	3·2481	575·12
58·0	2·2835	404·33	83·0	3·2678	578·60
58·5	2·3032	407·81	83·5	3·2875	582·09
59·0	2·3229	411·30	84·0	3·3071	585·58
59·5	2·3426	414·78	84·5	3·3268	589·06
60·0	2·3622	418·27	85·0	3·3465	592·55
60·5	2·3819	421·75	85·5	3·3662	596·03
61·0	2·4016	425·24	86·0	3·3859	599·52
61·5	2·4213	428·73	86·5	3·4056	603·00
62·0	2·4410	432·21	87·0	3·4253	606·49
62·5	2·4607	435·70	87·5	3·4449	609·98
63·0	2·4804	439·18	88·0	3·4646	613·46
63·5	2·5000	442·67	88·5	3·4843	616·95
64·0	2·5197	446·15	89·0	3·5040	620·43
64·5	2·5394	449·64	89·5	3·5237	623·92
65·0	2·5591	453·12	90·0	3·5434	627·40
65·5	2·5788	456·61	90·5	3·5631	630·89
66·0	2·5985	460·10	91·0	3·5827	634·37
66·5	2·6182	463·58	91·5	3·6024	637·81
67·0	2·6378	467·07	92·0	3·6221	641·37
67·5	2·6575	470·55	92·5	3·6418	644·83
68·0	2·6772	474·04	93·0	3·6615	648·32
68·5	2·6969	477·52	93·5	3·6812	651·80
69·0	2·7166	481·01	94·0	3·7008	655·29
69·5	2·7363	481·50	94·5	3·7205	658·77
70·0	2·7559	487·98	95·0	3·7402	662·26
70·5	2·7756	491·47	95·5	3·7599	665·74
71·0	2·7953	494·95	96·0	3·7796	669·23
71·5	2·8150	498·44	96·5	3·7993	672·72
72·0	2·8347	501·92	97·0	3·8190	676·20
72·5	2·8544	505·41	97·5	3·8386	679·69
73·0	2·8741	508·89	98·0	3·8583	683·17
73·5	2·8937	512·38	98·5	3·8780	686·66
74·0	2·9134	515·86	99·0	3·8977	690·14
74·5	2·9331	519·35	99·5	3·9144	693·63
75·0	2·9528	522·84			

Rubber Saturated Tape.—India-rubber cables are generally taped with rubber saturated tape, which weighs approximately 0·36 lb. per square yard; its thickness is 0·3 mm. (11·8 mils). One-fifth overlap is usually adopted, which gives for the area of tape required for any core:—

(Mean tape diameter in mm.) 8·714 = square yards per nautical mile of core.

The weight of the tape will therefore be:—

(Mean tape diameter in mm.) 8·714 × 0·36 = lb. per nautical mile of core.

But (8·714 × 0·36) = 3·137, or approximately equal to π; therefore the number of lb. of tape required per nautical mile of core is approximately equal to the circumference of the core in millimetres corresponding to the mean tape diameter.

Table No. 86 gives the circumference of circles of various diameters.

Again, if d be the mean tape diameter of any core in millimetres (that is, equal to the diameter of the core, plus 0·3 mm. for one layer of tape), then the number of square metres required to cover 1 kilometre of core will be

$$\frac{3 \cdot 1416\, d \times 1000 \times 1000}{1000 \times 1000} + \tfrac{1}{5}\text{th overlap} = (3 \cdot 1416 + 0 \cdot 7854)\, d$$
$$= 3 \cdot 927\, d,$$

or, roundly, 4 d.

The weight of the tape being approximately 0·2 kilogrammes per square metre, therefore the weight of tape required in kilogrammes per kilometre is equal to 0·8 d.

TABLE NO.. 86.—CIRCUMFERENCE OF CIRCLES OF VARIOUS DIAMETERS.

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
0	0·000	0·314	0·628	0·942	1·257	1·571	1·885	2·199	2·513	2·827
1	3·142	3·456	3·770	4·084	4·398	4·712	5·027	5·341	5·655	5·969
2	6·283	6·597	6·912	7·226	7·540	7·854	8·168	8·482	8·796	9·111
3	9·425	9·739	10·05	10·37	10·68	11·00	11·31	11·62	11·94	12·25
4	12·57	12·88	13·19	13·51	13·82	14·14	14·45	14·77	15·08	15·39
5	15·71	16·02	16·34	16·65	16·96	17·28	17·59	17·91	18·22	18·54
6	18·85	19·16	19·48	19·79	20·11	20·42	20·73	21·05	21·36	21·68
7	21·99	22·31	22·62	22·93	23·25	23·56	23·88	24·19	24·50	24·82
8	25·13	25·45	25·76	26·08	26·39	26·70	27·02	27·33	27·65	27·96
9	28·27	28·59	28·90	29·22	29·53	29·85	30·16	30·47	30·79	31·10
10	31·42	31·73	32·04	32·36	32·67	32·99	33·30	33·62	33·93	34·24
11	34·56	34·87	35·19	35·50	35·81	36·13	36·44	36·76	37·07	37·38
12	37·70	38·01	38·33	38·64	38·96	39·27	39·58	39·90	40·21	40·53
13	40·84	41·15	41·47	41·78	42·10	42·41	42·73	43·04	43·35	43·67
14	43·98	44·30	44·61	44·92	45·24	45·55	45·87	46·18	46·50	46·81
15	47·12	47·44	47·75	48·07	48·38	48·69	49·01	49·32	49·64	49·95
16	50·27	50·58	50·89	51·21	51·52	51·84	52·15	52·46	52·78	53·09
17	53·41	53·72	54·04	54·35	54·66	54·98	55·29	55·61	55·92	56·23
18	56·55	56·86	57·18	57·49	57·81	58·12	58·43	58·75	59·06	59·38
19	59·69	60·00	60·32	60·63	60·95	61·26	61·58	61·89	62·20	62·52
20	62·83	63·15	63·46	63·77	64·09	64·40	64·72	65·03	65·35	65·66
21	65·97	66·29	66·60	66·92	67·23	67·54	67·86	68·17	68·49	68·80
22	69·12	69·43	69·74	70·06	70·37	70·69	71·00	71·31	71·63	71·94
23	72·26	72·57	72·88	73·20	73·51	73·83	74·14	74·46	74·77	75·08
24	75·40	75·71	76·03	76·34	76·65	76·97	77·28	77·60	77·91	78·23
25	78·54	78·85	79·17	79·48	79·80	80·11	80·42	80·74	81·05	81·37

TABLE No. 86.—CIRCUMFERENCE OF CIRCLES OF VARIOUS DIAMETERS—*continued.*

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
26	81·68	82·00	82·31	82·62	82·94	83·25	83·57	83·88	84·19	84·51
27	84·82	85·14	85·45	85·77	86·08	86·39	86·71	87·02	87·34	87·65
28	87·96	88·28	88·59	88·91	89·22	89·54	89·85	90·16	90·48	90·79
29	91·11	91·42	91·73	92·05	92·36	92·68	92·99	93·31	93·62	93·93
30	94·25	94·56	94·88	95·19	95·50	95·82	96·13	96·45	96·76	97·08
31	97·39	97·70	98·02	98·33	98·65	98·96	99·27	99·59	99·90	100·2
32	100·5	100·8	101·2	101·5	101·8	102·1	102·4	102·7	103·0	103·4
32	103·7	104·0	104·3	104·6	104·9	105·2	105·6	105·9	106·2	106·5
34	106·8	107·1	107·4	107·8	108·1	108·4	108·7	109·0	109·3	109·6
35	110·0	110·3	110·6	110·9	111·2	111·5	111·8	112·2	112·5	112·8
36	113·1	113·4	113·7	114·0	114·4	114·7	115·0	115·3	115·6	115·9
37	116·2	116·6	116·9	117·2	117·5	117·8	118·1	118·4	118·8	119·1
38	119·4	119·7	120·0	120·3	120·6	121·0	121·3	121·6	121·9	122·2
39	122·5	122·8	123·2	123·5	123·8	124·1	124·4	124·7	125·0	125·3
40	125·7	126·0	126·3	126·6	126·9	127·2	127·5	127·9	128·2	128·5
41	128·8	129·1	129·4	129·7	130·1	130·4	130·7	131·0	131·3	131·6
42	131·9	132·3	132·6	132·9	133·2	133·5	133·8	134·1	134·5	134·8
43	135·1	135·4	135·7	136·0	136·3	136·7	137·0	137·3	137·6	137·9
44	138 2	138·5	138·9	139·2	139·5	139·8	140·1	140·4	140·7	141·1
45	141·4	141·7	142·0	142·3	142·6	142·9	143·3	143·6	143·9	144·2
46	144·5	144·8	145·1	145·5	145·8	146·1	146·4	146·7	147·0	147·3
47	147·7	148·0	148·3	148·6	148·9	149·2	149·5	149·9	150·2	150·5
48	150·8	151·1	151·4	151·7	152·1	152·4	152·7	153·0	153·3	153·6
49	153·9	154·3	154·6	154·9	155·2	155·5	155·8	156·1	156·5	156·8
50	157·1	157·4	157·7	158·0	158·3	158·7	159·0	159·3	159·6	159·9

TABLE No. 86.—CIRCUMFERENCE OF CIRCLES OF VARIOUS DIAMETERS—*continued.*

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
51	160·2	160·5	160·8	161·2	161·5	161·8	162·1	162·4	162·7	163·0
52	163·4	163·7	164·0	164·3	164·6	164·9	165·2	165·6	165·9	166·2
53	166·5	166·8	167·1	167·4	167·8	168·1	168·4	168·7	169·0	169·3
54	169·6	170·0	170·3	170·6	170·9	171·2	171·5	171·8	172·2	172·5
55	172·8	173·1	173·4	173·7	174·0	174·4	174·7	175·0	175·3	175·6
56	175·9	176·2	176·6	176·9	177·2	177·5	177·8	178·1	178·4	178·8
57	179·1	179·4	179·7	180·0	180·3	180·6	181·0	181·3	181·6	181·9
58	182·2	182·5	182·8	183·2	183·5	183·8	184·1	184·4	184·7	185·0
59	185·4	185·7	186·0	186·3	186·6	186·9	187·2	187·6	187·9	188·2
60	188·5	188·8	189·1	189·4	189·8	190·1	190·4	190·7	191·0	191·3
61	191·6	192·0	192·3	192·6	192·9	193·2	193·5	193·8	194·2	194·5
62	194·8	195·1	195·4	195·7	196·0	196·3	196·7	197·0	197·3	197·6
63	197·9	198·2	198·5	198·9	199·2	199·5	199·8	200·1	200·4	200·7
64	201·1	201·4	201·7	202·0	202·3	202·6	202·9	203·3	203·6	203·9
65	204·2	204·5	204·8	205·1	205·5	205·8	206·1	206·4	206·7	207·0
66	207·3	207·7	208·0	208·3	208·6	208·9	209·2	209·5	209·9	210·2
67	210·5	210·8	211·1	211·4	211·7	212·1	212·4	212·7	213·0	213·3
68	213·6	213·9	214·3	214·6	214·9	215·2	215·5	215·8	216·1	216·5
69	216·8	217·1	217·4	217·7	218·0	218·3	218·7	219·0	219·3	219·6
70	219·9	220·2	220·5	220·9	221·2	221·5	221·8	222·1	222·4	222·7
71	223·1	223·4	223·7	224·0	224·3	224·6	224·9	225·3	225·6	225·9
72	226·2	226·5	226·8	227·1	227·5	227·8	228·1	228·4	228·7	229·0
73	229·3	229·7	230·0	230·3	230·6	230·9	231·2	231·5	231·8	232·2
74	232·5	232·8	233·1	233·4	233·7	234·0	234·4	234·7	235·0	235·3
75	235·6	235·9	236·2	236·6	236·9	237·2	237·5	237·8	238·1	238·4

TABLE No. 86.—CIRCUMFERENCE OF CIRCLES OF VARIOUS DIAMETERS—*continued.*

Diam.	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
76	238·8	239·1	239·4	239·7	240·0	240·3	240·6	241·0	241·3	241·6
77	241·9	242·2	242·5	242·8	243·2	243·5	243·8	244·1	244·4	244·7
78	245·0	245·4	245·7	246·0	246·3	246·6	246·9	247·2	247·6	247·9
79	248·2	248·5	248·8	249·1	249·4	249·8	250·1	250·4	250·7	251·0
80	251·3	251·6	252·0	252·3	252·6	252·9	253·2	253·5	253·8	254·2
81	254·5	254·8	255·1	255·4	255·7	256·0	256·4	256·7	257·0	257·3
82	257·6	257·9	258·2	258·6	258·9	259·2	259·5	259·8	260·1	260·4
83	260·8	261·1	261·4	261·7	262·0	262·3	262·6	263·0	263·3	263·6
84	263·9	264·2	264·5	264·8	265·2	265·5	265·8	266·1	266·4	266·7
85	267·0	267·3	267·7	268·0	268·3	268·6	268·9	269·2	269·5	269·9
86	270·2	270·5	270·8	271·1	271·4	271·7	272·1	272·4	272·7	273·0
87	273·3	273·6	273·9	274·3	274·6	274·9	275·2	275·5	275·8	276·1
88	276·5	276·8	277·1	277·4	277·7	278·0	278·3	278·7	279·0	279·3
89	279·6	279·9	280·2	280·5	280·9	281·2	281·5	281·8	282·1	282·4
90	282·7	283·1	283·4	283·7	284·0	284·3	284·6	284·9	285·3	285·6
91	285·9	286·2	286·5	286·8	287·1	287·5	287·8	288·1	288·4	288·7
92	289·0	289·3	289·7	290·0	290·3	290·6	290·9	291·2	291·5	291·9
93	292·2	292·5	292·8	293·1	293·4	293·7	294·1	294·4	294·7	295·0
94	295·3	295·6	295·9	296·3	296·6	296·9	297·2	297·5	297·8	298·1
95	298·5	298·8	299·1	299·4	299·7	300·0	300·3	300·7	301·0	301·3
96	301·6	301·9	302·2	302·5	302·8	303·2	303·5	303·8	304·1	304·4
97	304·7	305·0	305·4	305·7	306·0	306·3	306·6	306·9	307·2	307·6
98	307·9	308·2	308·5	308·8	309·1	309·4	309·8	310·1	310·4	310·7
99	311·0	311·3	311·6	312·0	312·3	312·6	312·9	313·2	313·5	313·8
100	314·2	..	..	..	..	..	..	..	..	..

The price of such rubber saturated tape is approximately 1·5*s*. per lb., or 3·3*s*. per kilogramme.

If the taped core is run through ozokerit compound, the weight of compound taken up by the tape is equal to:

	0·1 (circumference of core in mm.)	= kilogrammes per kilometre,
or	1·115 (diameter of core in mm.)	= lb. per statute mile,
or	1·285 (diameter of core in mm.)	= lb. per nautical mile.

The ozokerit compound consists of 3 parts of ozokerit (specific gravity 0·95, melting-point 140°–170° F., price 58*s*. per 100 kilogrammes) to 1 part of Stockholm tar (specific gravity 1·015, price 21*s*. per 100 kilogrammes), the Stockholm tar having been previously boiled for four to five hours. The price of the compound is approximately 49*s*. per 100 kilogrammes, or 22*s*. 3*d*. per 100 lb.

Ozokerit Tape.—The tape is first tanned and then saturated with the above described compound.

It is generally applied to india-rubber cores with one-fifth overlap, and therefore the tape required is:

(mean diameter in millimetres) 4 = square metres per kilometre.

The tape usually has a thickness of 0·35 mm. (14 mils), and weighs 0·25 kilogramme per square metre; therefore, the weight of tape required in kilogrammes per kilometre is equal to the mean diameter of the taped core in millimetres. The price of the tape is approximately 0·5*s*. per square metre. A heavier tape is sometimes used, having a thickness of 0·5 mm. (20 mils), which weighs 0·175 kilogramme per square metre and takes up 0·236 kilogramme of ozokerit compound per square metre. The weight required in kilogrammes per kilometre is given by

(mean tape diameter in millimetres) 1·6.

The cost of tape and ozokerit compound is approximately 0·5*s*. per square metre.

Gutta-percha core is generally taped with cotton tape, with an overlap of one-fifth the width. The tape required per nautical mile is given by

	8·714 (mean diameter in millimetres)	= square yards of tape,
or	4 " " " "	= square metres of tape per kilometre.

The tape weighs 0·3 lb. per square yard, and its thickness is 0·3 mm. (12 mils).

If the tape is tarred the thickness is increased to 0·5 mm. (20 mils), and the weight of tar on the tape is 0·4 lb. per square yard.

Dry core telephone cables are generally taped under the lead sheath with one layer of cotton tape applied with an overlap of one-fifth the width. If d is the diameter over the laid-up pairs, plus 0·3 mm. for one layer of tape, then $4\,d$ = square metres of tape required per kilometre, $7{\cdot}7\,d$ = square yards of tape required per statute mile, $0{\cdot}8\,d$ = weight of tape required in kilogrammes per kilometre, $2{\cdot}84\,d$ = weight of tape required in lb. per statute mile. The price of such cotton tape is approximately 1*s*. per square metre, or 5*s*. per kilogramme, or 2·3*s*. per lb.

Bitumen Cables.—Various tapes are used, such as:

Bitumen tape A.	Weight per square metre .	0·5 kilogramme.
	" " yard . .	0·922 lb.
	Thickness of tape . . .	0·5 mm. (20 mils).
	Price per kilogramme, about .	1·65*s*.
	Price per lb., about . .	0·75*s*.

Bitumen tape B.	Weight per square metre	0·235 kilogramme.
	,, ,, yard	0·433 lb.
	Thickness of tape	0·4 mm. (16 mils).
	Price per kilogramme, about	2·3*s.*
	Price per lb., about	1·0*s.*

TABLE No. 87.—COPPER TAPE. 0·25 mm. thick (10 mils).

The price of copper tape is equal to the basis price (see page 92), plus the following "extra" price :—

Width of Tape		Extra Price	
mm.	mils	Shillings per 100 kilog.	Pence per lb.
100 to 80	394 to 316	22·0	1·2
79 60	311 236	23·5	1·28
59 40	232 158	25·0	1·36
39·9 30	157 118	27·0	1·47
29·9 25	117 99	31·0	1·68
24·9 20	98 79	36·0	1·96
19·9 15	78 59	40·0	2·17
14·9 10	58 39	46·0	2·5
9·9 5	38 20	66·0	3·6

(B) Braids.

The usual sizes of braiding machines are :—

16 bobbin, which run at approximately 50 revolutions per minute
20 ,, ,, ,, 30 ,, ,,
24 ,, ,, ,, 20 ,, ,,
48 ,, ,, ,, 10 ,, ,,

The usual braiding materials are cotton, jute, hemp, and asbestos yarn; cotton being used for small size cables, jute and hemp for the large size cables, and asbestos yarn for fire-resisting cables.

Cables requiring a flexible armour are sometimes braided with steel wires, phosphor bronze wires, or raw hide strips.

The angle of lay of the braiding varies between 50° and 35°, according to the size of the cable or special requirements. Curve No. 12 gives lay angles of 50°, 45°, 40°, and 35°, from which the length of cable braided per revolution of the machine can be read off.

Cotton Braid.—Cotton is measured by the following scale :—
54 in. = 1 thread.
4,320 in. = 80 threads = 1 lea.
30,240 in. = 560 threads = 7 leas = 1 hank = 840 yards.

All hanks of cotton measure 840 yards in length, and the number of hanks of any cotton that weigh 1 lb. determines the size of that cotton, and is known as the "count" of the cotton, thus :—

1 lb. = 20 × 840 yards = 20 hanks of 20's count cotton.
1 lb. = 40 × 840 yards = 40 hanks of 40's count cotton.
1 lb. = 20 × 840 yards = 20 hanks of 40/2 double cotton.
A spindle of cotton = 18 hanks = 15,120 yards.

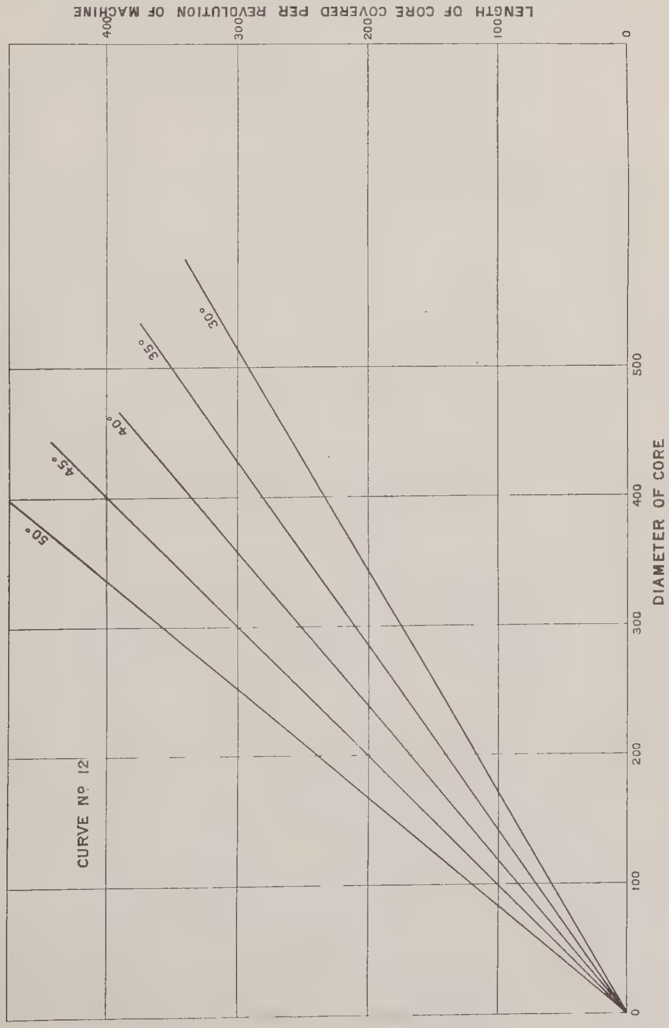


Table No. 88 shows the weight of various cottons.

TABLE No. 88.—WEIGHT OF COTTON.

Single Cotton Counts	Number of Yards per lb.	Doubled Cotton Counts	Number of Yards per lb.
6	5040	6/2	2520
8	6720	8/2	3360
12	10080	12/2	5040
16	13440	16/2	6720
20	16800	20/2	8400
30	25200	30/2	12600
40	33600	40/2	16800
60	50400	60/2	25200

A braiding of 30/2 cotton increases the diameter of the cable by 0·75 mm. (30 mils), and

one braiding of 20/2 cotton increases the diameter by 1·0 mm. (39 mils)
" " 16/2 " " " 1·1 " (43 ")
" " 12/2 " " " 1·2 " (47 ")
" " 8/2 " " " 1·4 " (55 ")

The weight of cotton braid is approximately equal to

(sectional area of braid in square mm.) 0·55 = kilogramme per kilometre.

If the diameter under and over the braid be d and D mm. respectively, then the weight of cotton in kilogrammes per kilometre is given by

$$0·432\,(D^2 - d^2),$$

or the weight of cotton in lb. per statute mile is given by

$$1·53\,(D^2 - d^2).$$

If the diameter d and D be expressed in mils, then the weight of cotton in lb. per statute mile is given by

$$\frac{D^2 - d^2}{990}.$$

The price of braiding cotton varies from time to time; it is quoted in various weekly journals.

Cotton braid soaks up 130 per cent. of its weight of cable-wax compound (black), or 125 per cent. of its weight of ceresine compound (red).

The black wax compound for finishing off cotton-braided cables is usually composed of hard black wax and soft black wax in varying proportions according to their hardness: the price of the compound is approximately 28/– per 100 lb., or 61·7/– per 100 kilogrammes.

The red wax compound is usually composed of ceresine wax, half-white wax and cable crimson (dye), and costs approximately 37·8/- per 100 lb., or 83·3/– per 100 kilogrammes.

Jute Braid:—

A braiding of 8 oz. jute increases the diameter by 1·5 mm.
" " 16 oz. " " " 2·0 "
" " 2 lb. " " " 3·0 "
" " 4 lb. " " " 4·0 "

The weight of jute braid is approximately equal to

$$0 \cdot 43 \, (D^2 - d^2) \text{ kilogrammes per kilometre}$$

where D and d are the diameters in millimetres over and under the braid respectively; or the weight in lb. per statute mile is equal to

$$1 \cdot 53 \, (D^2 - d^2).$$

If the diameters D and d are expressed in mils, then the weight of jute in lb. per statute mile is equal to

$$\frac{D^2 - d^2}{990}.$$

The jute braid is generally run through Stockholm tar and finished off with the wax compound (ozokerit), as used for cotton-braided cables; the weight of the tar soaked up is approximately equal to 80 per cent of the jute weight; the weight of the compound is also approximately 80 per cent. of the jute weight.

The price of jute yarn varies between 40/– and 66/– per 100 kilogrammes, or 18·2/– and 30/– per 100 lb.

The price of Stockholm tar is approximately 8/– per 100 lb., or 17·7/– per 100 kilogrammes.

The price of the wax compound is approximately 28/– per 100 lb., or 61·7/– per 100 kilogrammes.

Jute braiding is sometimes impregnated with a fire-resisting compound consisting of 50 per cent. of magnesium oxide, 25 per cent. of magnesium chloride and 25 per cent. of water; costing, approximately, 12/– per 100 kilogrammes, or 5·45/ per 100 lb. The amount of such compound taken up is approximately 200 per cent. of the weight of the jute braid.

The tensile strength of jute yarn is approximately 4 lb. per 1 lb. weight per nautical mile, that is to say a yarn weighing 2 lb. per nautical mile (known as 2 lb. yarn), should have a tensile strength of 8 lb.

Hemp Braids.—Some engineers prefer hemp braid for the larger cables, due to the fact that its tensile strength is much greater than that of jute; thus Italian hemp has a tensile strength of about 10 to 12 lb. per lb. of weight per nautical mile, Russian hemp a strength of 8 lb. per lb. of weight, whilst jute has a strength of only 4 lb. per lb. of weight. Care must be taken in selecting hemp, for experience has shown that Russian hemp rots very quickly in water, damp ground, and similar positions.

Table No. 89 gives the details of the various hemp braids used.

TABLE NO. 89.—HEMP BRAIDS.

Diameter of core in mils = d	Size of Hemp	Increase to Diameter for one Braid		Weight of Hemp in lb. per statute mile.
		mils	mm.	
40 to 200 . .	4 oz.	40	1·0	$0 \cdot 091 \, (d + 20)$
200 „ 1016 . .	8 „	61	1·55	$0 \cdot 1415 \, (d + 30 \cdot 5)$
1016 and larger .	16 „	87	2·21	$0 \cdot 185 \, (d + 43 \cdot 2)$
Special cables .	32 „	140	3·56	$0 \cdot 296 \, (d + 70)$

The price of hemp yarns is approximately as follows :—

	per 100 lb.	per 100 kilog.
4 oz.	80/– ..	176/–
8 oz.	58/– ..	128/–
16 oz.	56/– ..	123/–

Hemp-braided cables are usually run through Stockholm tar, and finished off with ozokerit wax compound. The weight of the tar is approximately equal to 80 per cent. of the weight of hemp, and the cost of the tar is approximately 8/– per 100 lb., or 17·7/– per 100 kilogrammes. The weight of the wax compound is also 80 per cent. of the weight of hemp and costs 28/– per 100 lb., or 61·7/– per 100 kilogrammes.

Asbestos Braid.

Table No. 90 gives the details of asbestos threads used for braiding; the 60/2 thread being most extensively used.

TABLE No. 90.—DETAILS OF ASBESTOS BRAID.

Size of asbestos thread	Increase of Diameter for one braid	Approximate Price in shillings	
		per kilog.	per lb.
60/2	2 mm.	7·5	3·4
40/2	..	6·0	2·7
20/2	..	2·75	1·25

The weight of asbestos thread braid is equal to

$$\frac{\pi}{4}(D^2 - d^2)\, 0 \cdot 84 = \text{kilogrammes per kilometre}$$

or $$0 \cdot 66\,(D^2 - d^2) = \text{kilogrammes per kilometre}$$

or $$2 \cdot 34\,(D^2 - d^2) = \text{lb. per statute mile}$$

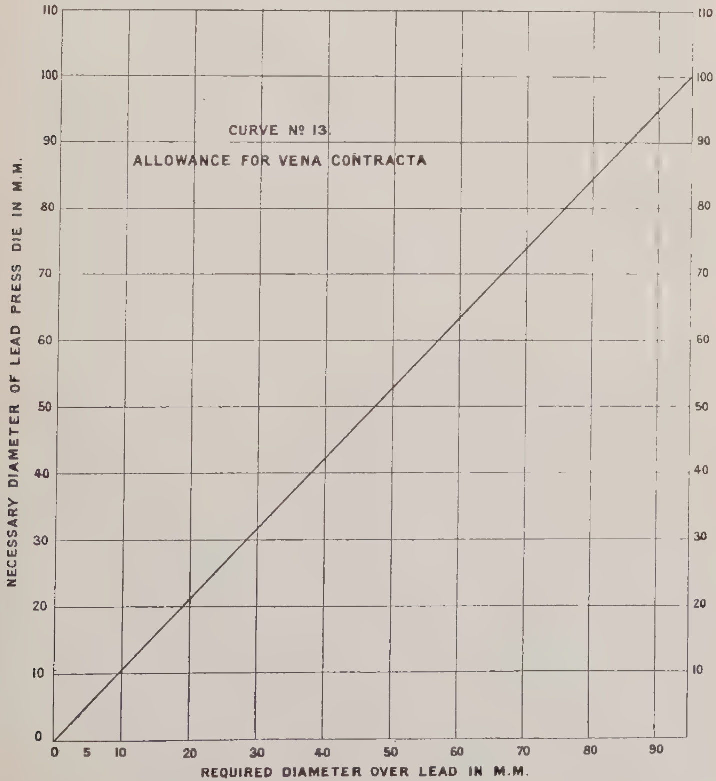
where D and d are the diameters over and under the braid respectively, in millimetres.

The braid is generally run through an asbestos compound consisting of equal parts of asbestos, magnesium superoxide and waterglass (silicate of soda), which costs approximately 40/– per 100 kilogrammes, or 18/– per 100 lb. The braid soaks up approximately 230 per cent. of its weight of the asbestos compound.

CHAPTER VIII.

LEAD SHEATH.

All cables insulated with hygroscopic material, such as paper or jute, must be provided with a continuous sheath of metallic or waterproof material. Rubber cables, for use in damp and exposed positions, are also generally similarly sheathed. The only materials which are commercially employed for this purpose are lead and vulcanised bitumen.



Lead has a specific gravity of 11·37 and a tensile strength of 1·26 kilogramme per square millimetre (= 1792 lb. per square inch).

Lead weighs 30,000 lb. per square inch section per nautical mile, or 23,560 lb. per circular inch section per nautical mile.

The melting-point of lead is 326° C. (619° F.), and it should be applied to cable at a temperature somewhat below 315° C. (599° F.) by means of a hydraulic press. For electric light and power cables pure new lead is generally used, but in the case of air-space telephone cables the lead is generally hardened by the addition of from 2 to 3 per cent. of tin, to insure against the sheath losing its circular section, and thus diminishing the air-space inclosed, on which depends the electrostatic capacity of the cable.

Tin has a specific gravity of 7·29 and melting-point at 228° C. (442° F.).

Owing to the contraction of the lead in passing through the lead-press die, an allowance must be made in order to obtain a given thickness of lead sheath. Curve No. 13 gives the diameter of the lead-press die necessary to obtain various outside diameters of lead sheathing.

The maximum diameter of cable which can be commercially lead-sheathed with the present practice is from 85 to 95 mm. (3·35 to 3·74 inches), owing to the short manufacturing length and the size of the cable drum.

Lead sheath for telephone cable is often specified to withstand an internal air pressure of from 2 to 5 atmospheres (29 to 75 lb. per square inch) for a period of from 2 to 24 hours; telephone cables immediately after leaving the lead press, and before being drummed, should be passed through a trough of cold water, so that at least 6 feet of their length is always submerged.

Tables Nos. 91, 92, and 93 show the thickness of the lead sheath as recommended by the Engineering Standards Committee. A variation of 10 per cent. in the thickness below the standard is allowed, but the average thickness must at least equal that specified. In the case of "between" sizes the thickness should be as that of the next larger size; also, for other working pressures the thickness to be the same as for the next higher voltage.

TABLE No. 91.—THICKNESS OF LEAD SHEATH FOR RUBBER CABLES FOR INTERNAL WIRING UP TO 330 VOLTS.

(As recommended by the Engineering Standards Committee.)

Conductor	Conductor Section		Lead Thickness		Conductor	Conductor Section		Lead Thickness	
L.W.G.	sq. in.	sq. mm.	mils	mm.	L.W.G.	sq. in.	sq. mm.	mils	mm.
1/18	0·001809	1·167	31	0·79	19/18	0·03374	21·77	43	1·09
3/22	·001811	1·168	31	0·79	7/14	·03459	22·32	43	1·09
1/17	·002463	1·589	31	0·79	7/·095″	·04878	31·47	45	1·14
3/20	·002994	1·931	33	0·84	19/·058″	·04962	31·78	46	1·17
1/16	·003217	2·075	32	0·81	19/16	·05998	38·70	47	1·19
1/15	·004071	2·627	32	0·81	19/14	·09372	60·47	52	1·32
7/22	·004237	2·734	33	0·84	19/·082″	·09847	63·53	53	1·35
1/14	·005026	3·243	33	0·84	37/16	·1167	75·32	55	1·40
3/18	·005322	3·434	34	0·86	19/·092″	·1239	79·97	56	1·42
7/20	·007005	4·519	35	0·89	19/·101″	·1494	96·38	59	1·50
7/18	·01245	8·036	37	0·94	37/15	·1478	95·33	58	1·47
19/20	·01898	12·24	39	0·99	19/12	·1584	102·2	59	1·50
7/16	·02214	14·28	40	1·02	37/14	·1824	117·7	62	1·57

TABLE NO. 92.—THICKNESS OF LEAD FOR PAPER OR JUTE CABLES.

(As recommended by the Engineering Standards Committee.)

Section of Conductor		Low Tension Cables up to 660 Volts								For 2200 Volt Pressure				For 3300 Volt Pressure				For 6600 Volt Pressure				For 11,000 Volt Pressure			
		Single Paper or Jute		Concentric Paper or Jute		Triple Concentric Paper or Jute		Twin or 3 Core Paper or Jute		Concentric Paper		Twin or 3 Core Paper		Concentric Paper		Twin or 3 Core Paper		Concentric Paper		Twin or 3 Core Paper		Concentric Paper		Twin or 3 Core Paper	
sq. in.	sq. mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
0·025	16	60	1·52	70	1·78	80	2·03	80	2·03	80	2·03	80	2·03	90	2·29	90	2·29	100	2·54	100	2·54	120	3·05	120	3·05
·050	32	60	1·52	80	2·03	90	2·29	90	2·29	90	2·29	90	2·29	100	2·54	100	2·54	110	2·79	110	2·79	130	3·30	130	3·30
·075	48	70	1·78	80	2·03	100	2·54	100	2·54	90	2·29	100	2·54	100	2·54	100	2·54	120	3·05	120	3·05	140	3·56	130	3·30
·100	64·5	70	1·78	90	2·29	100	2·54	100	2·54	100	2·54	110	2·79	100	2·54	110	2·79	120	3·05	120	3·05	140	3·56	140	3·56
·125	80·6	70	1·78	90	2·29	110	2·79	110	2·79	100	2·54	110	2·79	110	2·79	120	3·05	130	3·30	130	3·30	140	3·56	140	3·56
·150	97	80	2·03	100	2·54	110	2·79	110	2·79	110	2·79	120	3·05	110	2·79	120	3·05	130	3·30	130	3·30	150	3·81	150	3·81
·200	129	80	2·03	100	2·54	120	3·05	120	3·05	110	2·79	130	3·30	120	3·05	130	3·30	130	3·30	140	3·56	150	3·81	160	4·06
·250	161	90	2·29	110	2·79	130	3·30	130	3·30	120	3·05	130	3·30	130	3·30	140	3·56	140	3·56	150	3·81	160	4·06	170	4·32
·300	193	90	2·29	110	2·79	130	3·30	130	3·30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·350	226	90	2·29	120	3·05	140	3·56	140	3·56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·400	258	100	2·54	120	3·05	140	3·56	140	3·56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·500	323	100	2·54	130	3·30	150	3·81	150	3·81	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·600	387	110	2·79	130	3·30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·700	451	110	2·79	140	3·56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·750	484	110	2·79	140	3·56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·800	516	120	3·05	150	3·81	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
·900	581	120	3·05	150	3·81	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1·000	645	120	3·05	150	3·81	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table No. 93.—Lead

(As recommended by the

Section of Conductor		Low Tension Cables						For 2200 Volt Pressure						For 3300	
		Single		Concentric		Twin or 3 Core		Single		Concentric		Twin or 3 Core		Single	
sq. in.	sq. mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
0·025	16	70	1·78	80	2·03	80	2·03	70	1·78	80	2·03	90	2·29	70	1·78
·05	32	70	1·78	80	2·03	90	2·29	70	1·78	90	2·29	100	2·54	80	2·03
·075	48	70	1·78	90	2·29	100	2·54	80	2·03	90	2·29	110	2·79	80	2·03
·10	64·5	80	2·03	90	2·29	110	2·79	80	2·03	100	2·54	120	3·05	80	2·03
·125	80·6	80	2·03	100	2·54	110	2·79	80	2·03	100	2·54	120	3·05	90	2·29
·150	97	80	2·03	100	2·54	120	3·05	90	2·29	110	2·79	130	3·30	90	2·29
·20	129	90	2·29	110	2·79	130	3·30	90	2·29	110	2·79	130	3·30	90	2·29
·25	161	90	2·29	110	2·79	130	3·30	90	2·29	120	3·05	140	3·56	100	2·54
·30	193	90	2·29	120	3·05	140	3·56	..	..	..	..	..	..	..	..
·35	226	100	2·54	120	3·05	150	3·81	..	..	..	..	..	..	..	..
·40	258	100	2·54	130	3·30	160	4·06	..	..	..	..	..	..	..	..
·50	323	110	2·79	140	3·56	170	4·32	..	..		..	..	..	..	..
·60	387	110	2·79	140	3·56	..	..	..	..	..	..	..	..	..	..
·70	451	120	3·05	150	3·81	..	..	..	..	..	..	..	..	..	..
·75	484	120	3·05	150	3·81	..	..	..	..	..	..	..	..	..	..
·80	516	120	3·05	160	4·06	..	..	..	..	..	..	..	..	..	..
·90	581	120	3·05	160	4·06	..	..	..	..	..	..	..	..	..	..
1·0	645	130	3·30	170	4·32	..		..	..	..	..	..	..	..	..

THICKNESS FOR RUBBER CABLES.

Engineering Standards Committee.)

Volt Pressure				For 6600 Volt Pressure						For 11,000 Volt Pressure						Section of Conductor	
Con-centric		Twin or 3 Core		Single		Con-centric		Twin or 3 Core		Single		Con-centric		Twin or 3 Core			
mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	sq. in.	sq. mm.
80	2·03	100	2·54	80	2·03	90	2·29	110	2·79	90	2·29	100	2·54	120	3·05	0·025	16
90	2·29	110	2·79	80	2·03	100	2·54	120	3·05	90	2·29	100	2·54	130	3·30	·05	32
100	2·54	110	2·79	90	2·29	100	2·54	130	3·30	100	2·54	110	2·79	140	3·56	·075	48
100	2·54	120	3·05	90	2·29	110	2·79	130	3·30	100	2·54	110	2·79	150	3·81	·10	64·5
100	2·54	120	3·05	90	2·29	110	2·79	140	3·56	100	2·54	120	3·05	150	3·81	·125	80·6
110	2·79	130	3·30	100	2·54	120	3·05	140	3·56	100	2·54	120	3·05	160	4·06	·150	97
110	2·79	140	3·56	100	2·54	120	3·05	150	3·81	110	2·79	130	3·30	170	4·32	·20	129
120	3·05	140	3·56	100	2·54	130	3·30	160	4·06	110	2·79	130	3·30	170	4·32	·25	161
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·30	193
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·35	226
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·40	258
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·50	323
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·60	387
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·70	451
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·75	484
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·80	516
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·90	581
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1·0	645

The thicknesses of lead sheath recommended by various institutions are given in Tables Nos. 94, 95, and 96.

Table No. 97 gives the thickness of lead sheath generally applied to telephone cables by English manufacturers.

The thicknesses of lead sheath generally adopted by Continental cable manufacturers are given in Tables Nos. 98, 99, 100, 101, 102, and 103, for paper insulated, jute insulated, rubber insulated, paper and air space telephone, and jute telegraph cables.

Curve No. 14 shows the thickness of lead sheath for paper and rubber cables adopted by various Continental manufacturers.

TABLE No. 94.—THICKNESS OF LEAD FOR PAPER OR JUTE INSULATED CABLES UP TO 650 VOLTS PRESSURE. (As recommended by the Institution of Electrical Engineers.)

Conductor L.S.W.G. or inches	Section of Conductor		Lead Thickness		Conductor L.S.W.G. or inches	Section of Conductor		Lead Thickness	
	sq. in.	sq. mm.	mils	mm.		sq. in.	sq. mm.	mils	mm.
7/18	0·012456	8·036	60	1·52	19/·101″	0·14939	96·378	80	2·03
7/17	·016949	10·935	60	1·52	37/14	·18242	117·69	80	2·03
19/20	·018979	12·244	60	1·52	37/·082″	·19166	123·65	80	2·03
7/16	·022138	14·283	60	1·52	37/·092″	·24126	155·65	90	2·29
19/19	·023431	15·117	60	1·52	37/·101″	·29077	187·59	90	2·29
7/·068″	·024992	16·124	60	1·52	37/·110″	·34490	222·51	90	2·29
7/15	·028019	18·076	60	1·52	61/13	·39767	256·56	100	2·54
19/18	·033740	21·768	60	1·52	61/·098″	·45123	291·12	100	2·54
7/14	·034591	22·317	60	1·52	61/·101″	·47928	309 21	100	2·54
19/17	·045925	29·629	60	1·52	61/·108″	·54802	353·56	110	2·79
7/·095″	·048778	31·470	60	1·52	61/·110″	·57341	369·94	110	2·79
19/·058″	·049623	31·783	60	1·52	61/·118″	65420	422·06	110	2·79
19/16	·059983	38·699	70	1·78	91/·098″	·67308	434·25	110	2·79
19/15	·075916	48·978	70	1·78	91/·101″	·71492	461·24	110	2·79
19/14	·093724	60·467	70	1·78	91/12	·75802	489·05	120	3·05
19/·082″	·098468	63·528	70	1·78	91/·110″	·84801	547·10	120	3·05
37/16	·11675	75·324	70	1·78	91/·118″	·97584	629·58	120	3·05
19/13	·12395	79·967	70	1·78	127/·101″	·99765	643·68	120	3·05
37/15	·14776	95·332	80	2·03					

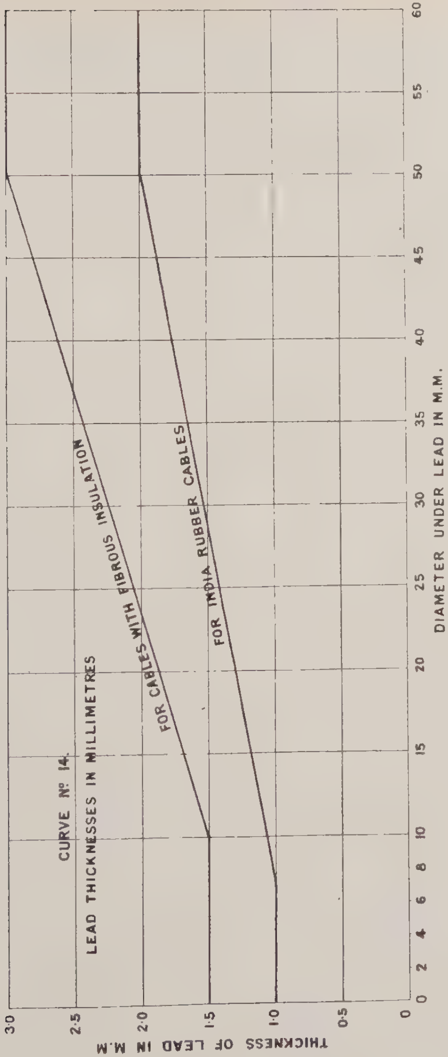

CURVE Nº 14.
LEAD THICKNESSES IN MILLIMETRES
FOR CABLES WITH FIBROUS INSULATION
FOR INDIA RUBBER CABLES
DIAMETER UNDER LEAD IN M.M.
THICKNESS OF LEAD IN M.M
0 2 4 6 8 10 15 20 25 30 35 40 45 50 55 60
0 0·5 1·0 1·5 2·0 2·5 3·0

TABLE No. 95.—THICKNESS OF LEAD FOR JUTE OR PAPER INSULATED CABLES FOR 700 VOLTS PRESSURE. (As recommended by the Verband Deutscher Elektrotechniker.)

Section of Conductor		Thickness of Lead		Section of Conductor		Thickness of Lead	
sq. mm.	sq. in.	mils	mm.	sq. mm.	sq. in.	mils	mm.
1·0	0·00155	47	1·2	95	0·147	67	1·7
1·5	·0023	47	1·2	120	·186	71	1·8
2·5	·0039	47	1·2	150	·232	75	1·9
4·0	·0062	55	1·4	185	·286	79	2·0
6	·0093	55	1·4	240	·372	83	2·1
10	·0155	55	1·4	310	·480	87	2·2
16	·0248	59	1·5	400	·620	91	2·3
25	·0387	59	1·5	500	·775	94·5	2·4
35	·0542	63	1·6	625	·968	102	2·6
50	·0775	63	1·6	800	1·240	110	2·8
70	·1085	67	1·7	1000	1·550	118	3·0

TABLE No. 96.—THICKNESS OF LEAD FOR JUTE AND PAPER INSULATED CABLE. (As recommended by the Verband Deutscher Elektrotechniker.)

Diameter under Lead		Thickness of Lead		Diameter under Lead		Thickness of Lead	
mm.	in.	mm.	mils	mm.	in.	mm.	mils
10	0·394	1·5	59	38	1·496	2·6	102
12	·473	1·6	63	41	1·614	2·7	106
14	·551	1·7	67	44	1·732	2·8	110
16	·630	1·7	67	47	1·850	3·0	118
18	·709	1·8	71	50	1·968	3·2	126
20	·788	1·9	75	54	2·126	3·2	126
23	·907	2·0	79	58	2·280	3·4	134
26	1·024	2·1	83	62	2·440	3·4	134
29	1·141	2·2	87	66	2·600	3·6	142
32	1·260	2·3	91	70	2·757	3·6	142
35	1·378	2·4	94·5				

TABLE No. 97.—THICKNESS OF LEAD FOR PAPER AND AIR-SPACE TELEPHONE CABLES. (English practice.)

Number of Pairs of Conductors	Armoured and Unarmoured Cables			
	10 lb. Conductors = 25 mils = 0·635 mm.		20 lb. Conductors = 36 mils = 0·914 mm.	
	mils	mm.	mils	mm.
1	60	1·52	70	1·78
2	60	1·52	70	1·78
3	60	1·52	70	1·78
5	70	1·78	80	2·03
8	70	1·78	80	2·03
10	70	1·78	80	2·03
14	70	1·78	80	2·03
15	80	2·03	80	2·03
20	80	2·03	90	2·29
26	80	2·03	90	2·29
52	90	2·29	90	2·29
75	90	2·29	110	2·79
77	90	2·29	110	2·79
102	90	2·29	110	2·79
153	90	2·29	120	3·05
204	90	2·29	130	3·30
255	125	3·17	130	3·30
300	125	3·17	130	3·30
400	125	3·17	130	3·30
500	125	3·17	..	..
600	125	3·17	..	..
700	125	3·17	..	..
800	125	3·17	..	..

TABLE No. 98.—LEAD THICKNE

Conductor Section		Low Tension up to 600 volt						For 1000 Volts Pressure						For 2000	
sq. mm.	sq. inch	Single		Twin		Three core		Single		Twin		Three core		Twin	
		mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm
10	0·0155	59	1·50	65	1·65	67	1·70	59	1·50	71	1·80	73	1·85	73	1·8
16	·0248	59	1·50	71	1·80	73	1·85	59	1·50	75	1·90	79	2·00	77	1·9
25	·0387	59	1·50	77	1·95	79	2·00	59	1·50	81	2·05	83	2·10	81	2·0
35	·0542	59	1·50	81	2·05	83	2·10	61	1·55	83	2·10	87	2·20	85	2·1
50	·0775	61	1·55	85	2·15	87	2·20	63	1·60	89	2·25	91	2·30	89	2·2
70	·1085	63	1·60	91	2·30	93	2·35	65	1·65	93	2·35	96·5	2·45	94·5	2·4
95	·147	65	1·65	94·5	2·40	98·5	2·50	67	1·70	98·5	2·50	100·5	2·55	98·5	2·5
120	·186	69	1·75	98·5	2·50	102	2·60	71	1·80	100·5	2·55	106	2·70	102	2·6
150	·232	73	1·85	104	2·65	106	2·70	75	1·90	106	2·70	110	2·80	108	2·7
185	·286	77	1·95	108	2·75	112	2·85	79	2·00	110	2·80	116	2·95	112	2·8
210	·325	79	2·00	112	2·85	116	2·95	81	2·05	114	2·90	118	3·00	116	2·9
240	·372	81	2·05	114	2·90	118	3·00	83	2·10	118	3·00	118	3·00	118	3·0
280	·434	83	2·10	118	3·00	118	3·00	85	2·15	118	3·00	118	3·00	118	3·0
310	·480	85	2·15	118	3·00	118	3·00	87	2·20	118	3·00	118	3·00	118	3·0
355	·550	87	2·20	..	..	..	..	89	2·25	..	..	..	..	..	..
400	·620	89	2·25	..	..	..	..	91	2·30	..	..	..	..	..	..
500	·775	93	2·35	..	..	..	..	94·5	2·40	..	..	..	..	..	..
625	·968	98·5	2·50	..	..	..	..	98·5	2·50	..	..	..	..	..	..
725	1·123	102	2·60	..	..	..	..	102	2·60	..	..	..	..	..	..
800	1·240	104	2·65	..	..	..	..	106	2·70	..	..	..	..	..	..
1000	1·550	110	2·80	..	..	..	..	110	2·80	..	..	..	..	..	..

FOR PAPER CABLES. (Continental Practice.)

Volts Pressure		For 3000 Volts Pressure						For 6000 Volts Pressure		For 10,000 Volts Pressure		For 20,000 Volts Pressure		Conductor Section	
Three core		Single		Twin		Three core		Three core		Three core		Three core			
mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	sq. mm.	sq. inch
75	1·90	59	1·50	75	1·90	77	1·95	85	2·15	100·5	2·55	110	2·80	10	0·0155
81	2·05	61	1·55	79	2·00	81	2·05	89	2·25	102	2·60	112	2·85	16	·0248
83	2·10	61	1·55	83	2·10	85	2·15	91	2·30	106	2·70	116	2·95	25	·0387
87	2·20	61	1·55	87	2·20	89	2·25	94·5	2·40	108	2·75	118	3·00	35	·0542
93	2·35	63	1·60	91	2·30	93	2·35	98·5	2·50	112	2·85	118	3·00	50	·0775
96·5	2·45	67	1·70	94·5	2·40	98·5	2·50	102	2·60	116	2·95	118	3·00	70	·1085
102	2·60	69	1·75	100·5	2·55	104	2·65	106	2·70	118	3·00	118	3·00	95	·147
106	2·70	73	1·85	104	2·65	108	2·75	110	2·80	118	3·00	118	3·00	120	·186
112	2·85	77	1·95	108	2·75	112	2·85	114	2·90	118	3·00	118	3·00	150	·232
116	2·95	81	2·05	114	2·90	118	3·00	..	..	..	..	..	..	185	·286
118	3·00	83	2·10	118	3·00	118	3·00	..	..	..	..	..	..	210	·325
118	3·00	85	2·15	118	3·00	118	3·00	..	..	..	..	..	..	240	·372
118	3·00	87	2·20	118	3·00	118	3·00	..	..	..	..	..	..	280	·434
118	3·00	87	2·20	118	3·00	118	3·00	..	..	..	..	..	..	310	·480
..	..	91	2·30	..	..	..	3·00	..	..	..	..	..	..	355	·550
..	..	93	2·35	..	..	..	..	..	..	..	..	..	..	400	·620
..	..	96·5	2·45	..	..	..	..	..	..	..	..	..	..	500	·775
..	..	100·5	2·55	..	..	..	..	..	..	..	..	..	..	625	·968
..	..	104	2·65	..	..	..	..	..	..	..	..	..	..	725	1·123
..	..	106	2·70	..	..	..	..	..	..	..	..	..	..	800	1·240
..	..	112	2·85	..	..	..	..	..	..	..	..	..	..	1000	1·550

TABLE No. 99.—LEAD THICKNESS FOR JUTE

Section of Conductor		For 500 volts Pressure				For 700 volts Pressure								For 1000			
		Single		Twin		Single		Concentric		Triple Concentric		Twin		Single		Concentric	
Sq. mm.	Sq. in.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm	mils	mm.	mils	mm.
1·0	0·00155	39·4	1·0	43·4	1·1	59	1·5	..	..	..	..	59	1·5	59	1·5	..	..
1·5	·0023	39·4	1·0	43·4	1·1	59	1·5	..	..	..	..	59	1·5	59	1·5	..	..
2·5	·0039	39·4	1·0	43·4	1·1	59	1·5	..	..	..	..	59	1·5	59	1·5	..	..
4·0	·0062	43·4	1·1	47	1·2	59	1·5	..	..	..	..	59	1·5	59	1·5	..	..
6	·0093	43·4	1·1	47	1·2	59	1·5	..	..	..	..	59	1·5	59	1·5	..	..
10	·0155	43·4	1·1	..	..	59	1·5	65	1·65	81	2·05	..	..	59	1·5	69	1·75
16	·0248	43·4	1·1	..	..	59	1·5	67	1·7	83	2·1	..	..	59	1·5	71	1·8
25	·0387	43·4	1·1	..	..	59	1·5	69	1·75	85	2·15	..	..	..	..	73	1·85
35	·0542	47	1·2	..	..	63	1·6	73	1·85	87	2·2	..	..	..	..	79	2·0
50	·0775	47	1·2	..	..	63	1·6	77	1·95	91	2·3	..	..	..	..	81	2·05
70	·1085	51	1·3	..	..	67	1·7	81	2·05	94·5	2·4	..	..	..	..	85	2·15
95	·147	51	1·3	..	..	67	1·7	85	2·15	98·5	2·5	..	..	..	..	89	2·25
120	·186	55	1·4	..	..	71	1·8	87	2·2	102	2·6	..	..	..	..	91	2·3
150	·232	59	1·5	..	..	75	1·9	91	2·3	106	2·7	..	..	..	..	94·5	2·4
185	·286	59	1·5	..	..	79	2·0	94·5	2·4	110	2·8	..	..	..	..	98·5	2·5
210	·325	63	1·6	..	..	79	2·0	96·5	2·45	112	2·85	..	..	..	..	100·5	2·55
240	·372	63	1·6	..	..	83	2·1	98·5	2·5	118	3·0	..	..	..	..	102	2·6
280	·434	67	1·7	..	..	83	2·1	104	2·65	118	3·0	..	..	..	..	104	2·65
310	·480	67	1·7	..	..	87	2·2	106	2·7	118	3·0	..	..	..	..	108	2·75
355	·550	71	1·8	..	..	87	2·2	106	2·7	..	..	..	..	..	..	110	2·8
400	·620	71	1·8	..	..	91	2·3	110	2·8	..	..	..	..	..	..	116	2·95
500	·775	75	1·9	..	..	94·5	2·4	116	2·95	..	..	..	..	..	..	118	3·0
625	·968	83	2·1	..	..	102	2·6	..	..	..	..	..	..	..	..	..	..
725	1·123	83	2·1	..	..	106	2·7	..	..	..	..	..	..	..	..	..	..
800	1·240	87	2·2	..	..	110	2·8	..	..	..	..	..	..	..	..	..	..
1000	1·550	91	2·3	..	..	118	3·0	..	..	..	..	..	..	..	..	..	..

INSULATED CABLES. (Continental Practice.)

volts Pressure				For 2000 volts Pressure						For 3000 volts Pressure					
Twin		Three Core		Concentric		Twin		Three Core		Concentric		Twin		Three Core	
mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
59	1·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	1·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	1·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	1·55	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	1·55	..	..	..	..	..	..	..	..	..	..	..	..	..	..
71	1·8	73	1·85	79	2·0	79	2·0	81	2·05	85	2·15	85	2·15	87	2·2
75	1·9	79	2·0	81	2·05	83	2·1	85	2·15	87	2·2	89	2·25	91	2·3
81	2·05	83	2·1	83	2·1	87	2·2	89	2·25	89	2·25	91	2·3	94·5	2·4
83	2·1	87	2·2	83	2·1	89	2·25	93	2·35	91	2·3	94·5	2·4	98·5	2·5
87	2·2	91	2·3	87	2·2	93	2·35	96·5	2·45	94·5	2·4	98·5	2·5	102	2·6
93	2·35	96·5	2·45	91	2·3	98·5	2·5	100·5	2·55	98·5	2·5	102	2·6	108	2·75
98·5	2·5	100·5	2·55	94·5	2·4	102	2·6	106	2·7	100·5	2·55	108	2·75	112	2·85
102	2·6	106	2·7	98·5	2·5	106	2·7	110	2·8	104	2·65	112	2·85	118	3·0
106	2·7	110	2·8	100·5	2·55	110	2·8	116	2·95	108	2·75	118	3·0	118	3·0
..	..	116	2·95	..	..	..	..	118	3·0	..	..	..	..	118	3·0
..	..	118	3·0	..	..	..	..	118	3·0	..	..	..	..	118	3·0
..	..	118	3·0	..	..	..	..	118	3·0	..	..	..	..	118	3·0
..	..	118	3·0	..	..	..	..	118	3·0	..	..	..	..	118	3·0
..	..	118	3·0	..	..	..	..	118	3·0	..	..	..	..	118	3·0
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE No. 100.—THICKNESS OF LEAD FOR RUBBER INSULATED CABLES.

(Continental Practice.)

Section of Conductor		For 500 volts Pressure						For 1000 volts Pressure						For 3000 volts Pressure					
		Single		Twin		Three Core		Single		Twin		Three Core		Single		Twin		Three Core	
sq.mm.	sq. in.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mm.
1·0	0·00155	39·4	1·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1·5	·0023	39·4	1·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2·5	·0039	39·4	1·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·0062	39·4	1·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·0093	39·4	1·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	·0155	39·4	1·0	47	1·20	47	1·2	39·4	1·0	47	1·2	49	1·25	41·4	1·05	53	1·35	53	1·35
16	·0248	39·4	1·0	49	1·25	49	1·25	41·4	1·05	49	1·25	51	1·30	43·4	1·10	55	1·40	55	1·40
25	·0387	41·4	1·05	51	1·30	53	1·35	41·4	1·05	53	1·35	55	1·40	43·4	1·10	57	1·45	59	1·50
35	·0542	43·4	1·1	55	1·4	57	1·45	43·4	1·1	55	1·4	57	1·45	45·3	1·15	59	1·50	61	1·55
50	·0775	45·3	1·15	59	1·5	59	1·5	45·3	1·15	59	1·5	61	1·55	47	1·20	63	1·60	65	1·65
70	·1085	45·3	1·15	61	1·55	63	1·6	47	1·2	63	1·6	65	1·65	49	1·25	65	1·65	69	1·75
95	·147	49	1·25	65	1·65	67	1·7	49	1·25	67	1·7	69	1·75	51	1·30	69	1·75	73	1·85
120	·186	49	1·25	69	1·75	71	1·8	51	1·3	71	1·8	73	1·85	53	1·35	73	1·85	77	1·95
150	·232	51	1·3	73	1·85	75	1·9	53	1·35	73	1·85	77	1·95	53	1·35	77	1·95	79	2·0

TABLE No. 101.—THICKNESS OF LEAD FOR PAPER AND AIR SPACE TELEPHONE CABLES. (Continental Practice.)

Number of Pairs of Wires	Diameter of Conductor 0·5/0·8 mm. = 20/31·5 mils						Diameter of Conductor 1·5/2·0 mm. = 60/79 mils			
	Plain Lead Covered		Open Wire Armoured		Closed Wire Armoured		Plain Lead Covered		Closed Wire Armoured	
	mm.	mils	mm.	mils	mm.	mils	mm.	mils	mils	mm.
2	1·3	51	1·3	51	1·2	47	..	..	..	..
3	1·3	51	1·3	51	1·2	47	..	..	..	..
4	1·4	55	1·3	51	1·3	51	1·8	71	1·5	59
5	1·5	59	1·4	55	1·4	55	2·0	79	1·7	67
7	1·5	59	1·4	55	1·4	55	2·0	79	1·7	67
10	1·7	67	1·6	63	1·5	59	2·1	83	1·8	71
14	1·7	67	1·6	63	1·5	59	2·3	91	2·0	79
21	2·0	79	1·8	71	1·7	67	2·5	98·5	2·2	87
28	2·0	79	1·8	71	1·7	67	2·5	98·5	2·2	87
52	2·2	87	2·0	79	1·8	71	3·0	118	2·5	98·5
56	2·2	87	2·0	79	1·8	71	3·0	118	2·5	98·5
84	2·2	87	2·0	79	1·8	71	..	..	..	..
100	2·5	98·5	2·2	87	2·0	79	..	..	..	..
112	2·5	98·5	2·2	87	2·0	79	..	..	..	..
140	2·8	110	2·5	98·5	2·1	83	..	..	..	..
153	2·8	110	2·5	98·5	2·2	87	..	..	..	..
168	2·8	110	2·5	98·5	2·2	87	..	..	..	..
200	3·0	118	2·8	110	2·5	98·5	..	..	..	..
224	3·0	118	2·8	110	2·5	98·5	..	..	..	..
250	3·0	118	2·8	110	2·5	98·5	..	..	..	..
300	3·0	118	3·0	118	2·5	98·5	..	..	..	..
350	3·0	118	3·0	118	2·5	98·5	..	..	..	..
400	3·0	118	3·0	118	2·75	108	..	..	..	..
500	3·0	118	3·0	118	2·75	108	..	..	..	..
600	3·0	118	3·0	118	3·0	118	..	..	..	..

TABLE No. 102.—LEAD THICKNESS FOR PAPER AND AIR SPACE TELEPHONE CABLES. (Continental Practice.)

Diameter of Cable under Lead		Unarmoured Cable		Armoured Cable	
mm.	inches	mm.	mils	mm.	mils
26·0 to 28·9	1·0236 to 1·1378	2·0	79	1·7	67
29·0 32·9	1·1417 1·2953	2·1	83	1·8	71
33·0 35·9	1·2992 1·4134	2·2	87	1·9	75
36·0 38·9	1·4173 1·5315	2·3	91	2·0	79
39·0 41·9	1·5354 1·6496	2·4	94·5	2·1	83
42·0 44·9	1·6535 1·7677	2·5	98·5	2·1	83
45·0 48·9	1·7717 1·9252	2·6	102	2·2	87
49·0 51·9	1·9291 2·0433	2·7	106	2·3	91
52·0 54·9	2·0472 2·1614	2·8	110	2·3	91
55·0 57·9	2·1654 2·2795	2·9	114	2·4	94·5
58·0 and upwards	2·2835	3·0	118	2·5	98·5

TABLE No. 103.—LEAD THICKNESS FOR TELEGRAPH CABLE WITH 1·5 MM. (60 MIL) CONDUCTORS. (Continental Practice.)

Number of Cores	Unarmoured Cable		Armoured Cable	
	mm.	mils	mm.	mils
4	1·6	63	1·5	59
7	1·7	67	1·6	63
14	1·8	71	1·7	67
28	2·0	79	2·0	79
56	2·5	98·5	2·4	94·5
112	3·0	118	2·8	110

Weight of Lead.

If D and d be the diameters over and under the lead sheath respectively, then the weight of lead is given by:

When D and d are expressed in millimetres—

$$8 \cdot 93\ (D^2 - d^2) = \text{kilogrammes per kilometre},$$
$$19 \cdot 68\ (D^2 - d^2) = \text{lb. per kilometre},$$
$$18 \cdot 0\ (D^2 - d^2) = \text{lb. per 1000 yards},$$
$$31 \cdot 68\ (D^2 - d^2) = \text{lb. per statute mile},$$
$$36 \cdot 52\ (D^2 - d^2) = \text{lb. per nautical mile}.$$

Or, when D and d are expressed in inches, then—

$$5762\ (D^2 - d^2) = \text{kilogrammes per kilometre},$$
$$12700\ (D^2 - d^2) = \text{lb. per kilometre},$$
$$11610\ (D^2 - d^2) = \text{lb. per 1000 yards},$$
$$20440\ (D^2 - d^2) = \text{lb. per statute mile},$$
$$23560\ (D^2 - d^2) = \text{lb. per nautical mile}.$$

Table No. 104 gives the weight of solid cylindrical lead in kilogrammes per kilometre for various diameters: the weight of lead sheath for any cable is equal to the difference between the weights corresponding to the external and internal diameters of the lead pipe.

Table No. 105 gives the weight of solid cylindrical lead in lb. per nautical mile.

The price of lead and tin can be ascertained from various weekly journals.

TABLE No. 101.—WEIGHT OF LEAD IN KILOG. PER KILOMETRE.

Cross section in sq. mm. × 11·37 = kilog. per kilometre.
Kilog. per kilometre × 3·548 = lb. per statute mile.

Diam.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
mm.										
2	36	39	43	47	51	56	60	65	70	75
3	80	86	91	97	103	109	116	122	129	136
4	143	150	157	165	173	181	189	197	206	214
5	223	232	241	251	260	270	280	290	300	311
6	321	332	343	354	366	377	389	401	413	425
7	438	450	463	476	489	502	516	529	543	557
8	572	586	600	615	630	645	660	676	692	707
9	723	739	756	772	789	806	823	840	858	875
10	893	911	929	947	966	984	1003	1022	1042	1061
11	1081	1100	1120	1140	1160	1181	1202	1222	1244	1265
12	1286	1307	1329	1351	1372	1395	1418	1440	1463	1486
13	1509	1533	1556	1580	1604	1628	1652	1676	1701	1725
14	1750	1775	1801	1826	1852	1878	1903	1930	1956	1983
15	2008	2036	2063	2090	2118	2145	2173	2201	2229	2258
16	2286	2315	2344	2373	2402	2431	2461	2490	2520	2550
17	2580	2611	2642	2672	2703	2735	2766	2797	2829	2861
18	2893	2925	2958	2991	3023	3056	3089	3123	3156	3190
19	3224	3258	3292	3326	3360	3396	3430	3466	3501	3536
20	3572	3608	3644	3680	3716	3753	3789	3826	3863	3900
21	3938	3976	4013	4051	4089	4128	4166	4205	4244	4282
22	4322	4361	4401	4440	4480	4520	4561	4602	4642	4683
23	4723	4765	4806	4847	4890	4932	4974	5016	5058	5100
24	5143	5186	5229	5273	5316	5360	5403	5447	5492	5536
25	5580	5626	5670	5716	5761	5807	5852	5859	5944	5990
26	6036	6083	6130	6177	6223	6270	6318	6366	6414	6462
27	6510	6558	6606	6655	6704	6753	6802	6852	6900	6950
28	7000	7051	7101	7152	7202	7253	7304	7356	7407	7458
29	7510	7561	7614	7666	7719	7771	7823	7876	7930	7983
30	8037	8090	8144	8198	8252	8306	8361	8416	8471	8526
31	8580	8636	8692	8748	8804	8860	8916	8974	9030	9087
32	9144	9201	9259	9316	9374	9430	9490	9548	9606	9665
33	9724	9783	9842	9900	9960	10023	10082	10142	10202	10262
34	10323	10384	10445	10506	10567	10629	10691	10753	10815	10877
35	10939	11002	11065	11128	11191	11254	11317	11381	11445	11509
36	11574	11638	11703	11768	11833	11898	11964	12027	12093	12159
37	12225	12291	12358	12424	12491	12558	12625	12695	12759	12826
38	12894	12962	13030	13098	13166	13235	13303	13372	13441	13510
39	13579	13648	13718	13792	13862	13932	14002	14074	14144	14216
40	14286	14358	14430	14503	14575	14647	14720	14793	14866	14939
41	15013	15086	15160	15233	15307	15382	15456	15530	15603	15678
42	15752	15827	15903	15978	16054	16129	16205	16281	16357	16434
43	16510	16587	16663	16740	16817	16895	16972	17054	17127	17205
44	17288	17368	17446	17525	17604	17684	17764	17844	17923	18003
45	18083	18164	18244	18325	18405	18488	18568	18650	18732	18814
46	18895	18978	19061	19144	19226	19309	19392	19476	19559	19643
47	19726	19810	19824	19979	20063	20148	20232	20317	20402	20487

Table No. 104.—Weight of Lead in Kilog. per Kilometre—*continued.*

Diam. mm.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
48	20575	20660	20746	20831	20917	21005	21091	21177	21265	21353
49	21440	21528	21617	21704	21793	21880	21969	22058	22147	22235
50	22325	22415	22504	22594	22684	22775	22865	22955	23045	23136
51	23227	23318	23410	23501	23593	23685	23777	23869	23961	24054
52	24146	24239	24332	24425	24518	24612	24705	24799	24896	24990
53	25084	25178	25274	25368	25464	25560	25656	25751	25847	25943
54	26040	26136	26233	26330	26427	26524	26622	26720	26817	26915
55	27013	27112	27208	27308	27407	27506	27605	27705	27804	27904
56	28004	28104	28204	28306	28406	28507	28608	28709	28810	28912
57	29014	29115	29217	29320	29422	29524	29628	29730	29834	29937
58	30041	30144	30248	30352	30456	30560	30665	30769	30875	30980
59	31086	31190	31296	31402	31509	31614	31721	31827	31934	32041
60	32148	32256	32362	32470	32578	32686	32794	32903	33011	33120
61	33229	33338	33447	33556	33665	33776	33885	33995	34105	34216
62	34327	34437	34549	34660	34772	34883	34995	35106	35219	35331
63	35443	35555	35669	35781	35895	36008	36121	36235	36349	36462
64	36577	36692	36806	36921	37036	37151	37266	37381	37497	37613
65	37729	37845	37962	38078	38195	38312	38429	38547	38664	38781
66	38899	39017	39135	39254	39372	39490	39610	39729	39847	39967
67	40087	40207	40326	40447	40567	40688	40808	40929	41049	41171
68	41292	41414	41536	41657	41779	41902	42025	42146	42269	42393
69	42516	42639	42763	42887	43010	43134	43258	43382	43507	43632
70	43757	43883	44008	44133	44259	44384	44510	44636	44763	44889
71	45016	45143	45270	45397	45524	45653	45780	45908	46036	46164
72	46293	46421	46551	46680	46809	46938	47067	47198	47328	47457
73	47587	47719	47850	47980	48111	48242	48374	48504	48636	48768
74	48900	49033	49165	49298	49431	49564	49697	49830	49963	50097
75	50228	50366	50500	50634	50768	50903	51037	51173	51308	51444
76	51580	51715	51852	51987	52123	52259	52398	42534	52672	52808
77	52946	53083	53221	53359	53497	53636	53771	53913	54052	54191
78	54330	54469	54609	54749	54889	55029	55170	55309	55440	55591
79	55732	55873	56014	56156	56297	56440	56582	56724	56866	57009
80	57151	57295	57438	57581	57724	57869	58012	58156	58301	58445
81	58590	58734	58880	59024	59169	59315	59461	59606	59753	59898
82	60045	60192	60338	60485	60633	60779	60927	61075	61223	61371
83	61519	61667	61815	61964	62113	62262	62411	62561	62710	62860
84	63010	63160	63310	63461	63612	63762	63913	64064	64215	64368
85	64519	64671	64823	64975	65127	65281	65433	65586	65739	65893
86	66046	66200	66354	66508	66662	66816	66970	67126	67281	67435
87	67591	67747	67902	68057	68214	68370	68527	68683	68840	68997
88	69153	69312	69468	69626	69783	69941	70099	70259	70417	70576
89	70734	70893	71052	71211	71372	71531	71691	71852	72012	72172
90	72333	72494	72654	72816	72977	73139	73300	73463	73624	73787
91	73949	74112	74275	74437	74601	74764	74926	75091	75255	75419
92	75583	75748	75912	76087	76241	76408	76572	76738	76903	77069
93	77235	77401	77568	77734	77902	78068	78235	78403	78570	78737
94	78906	79074	79241	79409	79579	79747	79916	80085	80254	80423
95	80593	80762	80933	81103	81273	81443	81614	81786	81956	82128

TABLE No. 105.—WEIGHT OF LEAD IN LB. PER NAUTICAL MILE.

Diameter mm.	Diameter inch	Lb. per nautical mile	Diameter mm.	Diameter inch	Lb. per nautical mile	Diameter mm.	Diameter inch	Lb. per nautical mile
0·1	0·0039	0·36529	4·7	0·1850	806·92	9·3	0·3661	3159·4
·2	·0079	1·4612	4·8	·1890	841·63	9·4	·3701	3227·7
·3	·0118	3·2876	4·9	·1929	877·06	9·5	·3740	3296·7
·4	·0157	5·8446	5·0	·1968	913·22	9·6	·3780	3366·5
·5	·0197	9·1322	5·1	·2008	950·12	9·7	·3819	3437·0
·6	·0236	13·150	5·2	·2047	987·74	9·8	·3858	3508·2
·7	·0276	17·899	5·3	·2087	1026·1	9·9	·3898	3580·2
·8	·0315	23·378	5·4	·2126	1065·2	10·0	·3937	3652·9
·9	·0354	29·588	5·5	·2165	1105·0	10·1	·3976	3726·3
1·0	·0394	36·529	5·6	·2205	1145·5	10·2	·4016	3800·5
1·1	·0433	44·200	5·7	·2244	1186·8	10·3	·4055	3875·3
1·2	·0472	52·601	5·8	·2283	1228·8	10·4	·4095	3951·0
1·3	·0512	61·734	5·9	·2323	1271·6	10·5	·4134	4027·3
1·4	·0551	71·597	6·0	·2362	1315·0	10·6	·4173	4104·4
1·5	·0591	82·190	6·1	·2402	1359·2	10·7	·4213	4182·2
1·6	·0630	93·514	6·2	·2441	1404·2	10·8	·4252	4260·7
1·7	·0669	105·57	6·3	·2480	1449·8	10·9	·4291	4340·0
1·8	·0709	118·35	6·4	·2520	1496·2	11·0	·4331	4420·0
1·9	·0748	131·87	6·5	·2559	1543·3	11·1	·4370	4500·7
2·0	·0787	146·12	6·6	·2598	1591·2	11·2	·4409	4582·2
2·1	·0827	161·09	6·7	·2638	1639·8	11·3	·4449	4664·3
2·2	·0866	176·80	6·8	·2677	1689·1	11·4	·4488	4747·3
2·3	·0905	193·24	6·9	·2717	1739·1	11·5	·4528	4830·9
2·4	·0945	210·41	7·0	·2756	1789·9	11·6	·4567	4915·3
2·5	·0984	228·31	7·1	·2795	1841·4	11·7	·4606	5000·4
2·6	·1024	246·94	7·2	·2835	1893·7	11·8	·4646	5086·3
2·7	·1063	266·30	7·3	·2874	1946·6	11·9	·4685	5172·8
2·8	·1102	286·39	7·4	·2913	2000·3	12·0	·4724	5260·1
2·9	·1142	307·21	7·5	·2953	2054·7	12·1	·4764	5348·2
3·0	·1181	328·76	7·6	·2992	2109·9	12·2	·4803	5437·0
3·1	·1220	351·04	7·7	·3031	2165·8	12·3	·4843	5526·5
3·2	·1260	374·06	7·8	·3071	2222·4	12·4	·4882	5616·7
3·3	·1299	397·80	7·9	·3110	2279·8	12·5	·4921	5707·6
3·4	·1339	422·27	8·0	·3150	2337·8	12·6	·4961	5799·3
3·5	·1378	447·48	8·1	·3189	2396·7	12·7	·5000	5891·7
3·6	·1417	473·42	8·2	·3228	2456·2	12·8	·5039	5984·9
3·7	·1457	500·08	8·3	·3268	2516·5	12·9	·5079	6078·8
3·8	·1496	527·47	8·4	·3307	2577·5	13·0	·5118	6173·4
3·9	·1535	555·60	8·5	·3346	2639·2	13·1	·5157	6268·7
4·0	·1575	584·46	8·6	·3386	2701·7	13·2	·5197	6364·8
4·1	·1614	614·05	8·7	·3425	2764·9	13·3	·5236	6461·6
4·2	·1654	644·37	8·8	·3465	2828·8	13·4	·5276	6559·1
4·3	·1693	675·42	8·9	·3504	2893·5	13·5	·5315	6657·4
4·4	·1732	707·20	9·0	·3543	2958·8	13·6	·5354	6756·4
4·5	·1772	739·71	9·1	·3583	3025·0	13·7	·5394	6856·1
4·6	·1811	772·95	9·2	·3623	3091·8	13·8	·5433	6956·5

TABLE No. 105.—WEIGHT OF LEAD IN LB. PER NAUTICAL MILE—*cont.*

Diameter mm.	Diameter inch	Lb. per nautical mile	Diameter mm.	Diameter inch	Lb. per nautical mile	Diameter mm.	Diameter inch	Lb. per nautical mile
13·9	0·5472	7057·8	18·5	0·7283	12502	23·1	0·9094	19492
14·0	·5512	7159·7	18·6	·7323	12637	23·2	·9134	19661
14·1	·5551	7262·3	18·7	·7362	12774	23·3	·9173	19831
14·2	·5591	7365·7	18·8	·7402	12911	23·4	·9213	20002
14·3	·5630	7469·8	18·9	·7441	13048	23·5	·9252	20173
14·4	·5669	7574·6	19·0	·7480	13187	23·6	·9291	20345
14·5	·5709	7680·2	19·1	·7520	13326	23·7	·9331	20518
14·6	·5748	7786·5	19·2	·7559	13466	23·8	·9370	20691
14·7	·5787	7893·5	19·3	·7598	13607	23·9	·9409	20866
14·8	·5827	8001·3	19·4	·7638	13748	24·0	·9449	21041
14·9	·5866	8109·8	19·5	·7677	13890	24·1	·9488	21216
15·0	·5906	8219·0	19·6	·7717	14033	24·2	·9528	21393
15·1	·5945	8329·0	19·7	·7756	14176	24·3	·9567	21570
15·2	·5984	8439·6	19·8	·7795	14321	24·4	·9606	21748
15·3	·6024	8551·1	19·9	·7835	14466	24·5	·9646	21926
15·4	·6063	8663·2	20·0	·7874	14611	24·6	·9685	22106
15·5	·6102	8776·1	20·1	·7913	14758	24·7	·9724	22286
15·6	·6142	8889·6	20·2	·7953	14905	24·8	·9764	22467
15·7	·6181	9004·0	20·3	·7992	15053	24·9	·9803	22648
15·8	·6220	9119·1	20·4	·8031	15202	25·0	·9843	22831
15·9	·6260	9234·9	20·5	·8071	15351	25·1	·9882	23014
16·0	·6299	9351·4	20·6	·8110	15501	25·2	·9921	23197
16·1	·6339	9468·6	20·7	·8150	15652	25·3	·9961	23382
16·2	·6378	9586·6	20·8	·8189	15804	25·4	1·0000	23567
16·3	·6417	9705·3	20·9	8228	15956	25·5	1·0039	23753
16·4	·6457	9824·8	21·0	·8268	16109	25·6	1·0079	23940
16·5	·6496	9945·0	21·1	·8307	16263	25·7	1·0118	24127
16·6	·6535	10065·9	21·2	·8346	16417	25·8	1·0157	24315
16·7	·6575	10187·6	21·3	·8386	16573	25·9	1·0197	24504
16·8	·6614	10309·9	21·4	·8425	16729	26·0	1·0236	24693
16·9	·6654	10433·0	21·5	·8465	16885	26·1	1·0276	24884
17·0	·6693	10557	21·6	·8504	17043	26·2	1·0315	25075
17·1	·6732	10681	21·7	·8543	17201	26·3	1·0354	25267
17·2	·6772	10807	21·8	·8583	17360	26·4	1·0394	25459
17·3	·6811	10933	21·9	·8622	17520	26·5	1·0433	25652
17·4	·6850	11059	22·0	·8661	17680	26·6	1·0472	25846
17·5	·6890	11187	22·1	·8701	17841	26·7	1·0512	26041
17·6	·6929	11315	22·2	·8740	18003	26·8	1·0551	26236
17·7	·6968	11444	22·3	·8780	18165	26·9	1·0591	26433
17·8	·7008	11574	22·4	·8819	18329	27·0	1·0630	26629
17·9	·7047	11704	22·5	·8858	18493	27·1	1·0669	26827
18·0	·7087	11835	22·6	·8898	18657	27·2	1·0709	27025
18·1	·7126	11967	22·7	·8937	18823	27·3	1·0748	27225
18·2	·7165	12100	22·8	·8976	18989	27·4	1·0787	27424
18·3	·7205	12233	22·9	·9016	19156	27·5	1·0827	27625
18·4	·7244	12367	23·0	·9055	19324	27·6	1·0866	27826

TABLE No. 105.—WEIGHT OF LEAD IN LB. PER NAUTICAL MILE—*cont.*

Diameter		Lb. per nautical mile	Diameter		Lb. per nautical mile	Diameter		Lb. per nautical mile
mm.	inch		mm.	inch		mm.	inch	
27·7	1·0905	28028	32·3	1·2717	38110	36·9	1·4528	49738
27·8	1·0945	28231	32·4	1·2756	38347	37·0	1·4567	50008
27·9	1·0984	28434	32·5	1·2795	38584	37·1	1·4606	50279
28·0	1·1024	28639	32·6	1·2835	38821	37·2	1·4646	59550
28·1	1·1063	28844	32·7	1·2874	39060	37·3	1·4685	50822
28·2	1·1102	29049	32·8	1·2913	39299	37·4	1·4724	51095
28·3	1·1142	29256	32·9	1·2953	39539	37·5	1·4764	51369
28·4	1·1181	29463	33·0	1·2992	39780	37·6	1·4803	51643
28·5	1·1220	29671	33·1	1·3031	40021	37·7	1·4842	51918
28·6	1·1260	29879	33·2	1·3071	40264	37·8	1·4882	52194
28·7	1·1299	30088	33·3	1·3110	40506	37·9	1·4921	52470
28·8	1·1339	30298	33·4	1·3150	40750	38·0	1·4961	52747
28·9	1·1378	30509	33·5	1·3189	40994	38·1	1·5000	53026
29·0	1·1417	30721	33·6	1·3228	41240	38·2	1·5039	53304
29·1	1·1457	30933	33·7	1·3268	41485	38·3	1·5079	53584
29·2	1·1496	31146	33·8	1·3307	41732	38·4	1·5118	53864
29·3	1·1535	31360	33·9	1·3346	41979	38·5	1·5157	54145
29·4	1·1575	31574	34·0	1·3386	42227	38·6	1·5197	54426
29·5	1·1614	31789	34·1	1·3425	42476	38·7	1·5236	54709
29·6	1·1653	32005	34·2	1·3465	42726	38·8	1·5276	54992
29·7	1·1693	32222	34·3	1·3504	42976	38·9	1·5315	55276
29·8	1·1732	32439	34·4	1·3543	43227	39·0	1·5354	55560
29·9	1·1772	32657	34·5	1·3583	43478	39·1	1·5394	55845
30·0	1·1811	32876	34·6	1·3622	43731	39·2	1·5433	56131
30·1	1·1850	33095	34·7	1·3661	43984	39·3	1·5472	56418
30·2	1·1889	33316	34·8	1·3701	44238	39·4	1·5512	56706
30·3	1·1929	33537	34·9	1·3740	44492	39·5	1·5551	56994
30·4	1·1968	33758	35·0	1·3779	44748	39·6	1·5591	57283
30·5	1·2008	33981	35·1	1·3819	45004	39·7	1·5630	57573
30·6	1·2047	34204	35·2	1·3858	45261	39·8	1·5669	57863
30·7	1·2087	34428	35·3	1·3898	45518	39·9	1·5709	58154
30·8	1·2126	34653	35·4	1·3937	45776	40·0	1·5748	58446
30·9	1·2165	34878	35·5	1·3976	46035	40·1	1·5787	58739
31·0	1·2205	35104	35·6	1·4016	46295	40·2	1·5827	59032
31·1	1·2244	35331	35·7	1·4055	46556	40·3	1·5866	59326
31·2	1·2283	35559	35·8	1·4094	46817	40·4	1·5905	59626
31·3	1·2323	35787	35·9	1·4134	47079	40·5	1·5945	59916
31·4	1·2362	36016	36·0	1·4173	47342	40·6	1·5984	60213
31·5	1·2402	36246	36·1	1·4213	47605	40·7	1·6024	60509
31·6	1·2441	36476	36·2	1·4252	47869	40·8	1·6063	60808
31·7	1·2480	36707	36·3	1·4291	48134	40·9	1·6102	61106
31·8	1·2520	36939	36·4	1·4331	48399	41·0	1·6142	61405
31·9	1·2559	37172	36·5	1·4370	48666	41·1	1·6181	61705
32·0	1·2598	37406	36·6	1·4409	48933	41·2	1·6220	62006
32·1	1·2638	37640	36·7	1·4449	49200	41·3	1·6260	62308
32·2	1·2677	37875	36·8	1·4488	49469	41·4	1·6299	62609

TABLE No. 105.—WEIGHT OF LEAD IN LB. PER NAUTICAL MILE—*cont.*

Diameter		Lb. per nautical mile	Diameter		Lb. per nautical mile	Diameter		Lb. per nautical mile
mm.	inch		mm.	inch		mm.	inch	
41·5	1·6339	62912	46·1	1·8150	77636	50·7	1·9961	93897
41·6	1·6378	63215	46·2	1·8189	77969	50·8	2·0000	94268
41·7	1·6417	63520	46·3	1·8228	78307	50·9	2·0039	94639
41·8	1·6457	63825	46·4	1·8268	78645	51·0	2·0079	95012
41·9	1·6496	64130	46·5	1·8307	78985	51·1	2·0118	95385
42·0	1·6535	64437	46·6	1·8346	79325	51·2	2·0157	95758
42·1	1·6575	64744	46·7	1·8386	79666	51·3	2·0197	96132
42·2	1·6614	65052	46·8	1·8425	80007	51·4	2·0236	96508
42·3	1·6654	65361	46·9	1·8465	80349	51·5	2·0276	96884
42·4	1·6693	65670	47·0	1·8504	80692	51·6	2·0315	97260
42·5	1·6732	65980	47·1	1·8543	81036	51·7	2·0354	97637
42·6	1·6772	66291	47·2	1·8583	81380	51·8	2·0394	98016
42·7	1·6811	66603	47·3	1·8622	81725	51·9	2·0433	98395
42·8	1·6850	66915	47·4	1·8661	82072	52·0	2·0472	98774
42·9	1·6890	67228	47·5	1·8701	82418	52·1	2·0512	99154
43·0	1·6929	67542	47·6	1·8740	82765	52·2	2·0551	99535
43·1	1·6968	67856	47·7	1·8779	83114	52·3	2·0591	99917
43·2	1·7008	68172	47·8	1·8819	83463	52·4	2·0630	100299
43·3	1·7047	68488	47·9	1·8858	83812	52·5	2·0669	100682
43·4	1·7087	68804	48·0	1·8898	84163	52·6	2·0709	101067
43·5	1·7126	69122	48·1	1·8937	84514	52·7	2·0748	101451
43·6	1·7165	69440	48·2	1·8976	84865	52·8	2·0787	101836
43·7	1·7205	69759	48·3	1·9016	85218	52·9	2·0827	102223
43·8	1·7244	70078	48·4	1·9055	85571	53·0	2·0866	102609
43·9	1·7283	70399	48·5	1·9094	85925	53·1	2·0905	102997
44·0	1·7323	70720	48·6	1·9134	86280	53·2	2·0945	103386
44·1	1·7362	71042	48·7	1·9173	86635	53·3	2·0984	103774
44·2	1·7402	71364	48·8	1·9213	86991	53·4	2·1024	104164
44·3	1·7441	71688	48·9	1·9252	87348	53·5	2·1063	104555
44·4	1·7480	72011	49·0	1·9291	87706	53·6	2·1102	104946
44·5	1·7520	72336	49·1	1·9331	88064	53·7	2·1142	105338
44·6	1·7559	72662	49·2	1·9370	88423	53·8	2·1181	105731
44·7	1·7598	72988	49·3	1·9409	88783	53·9	2·1220	106124
44·8	1·7638	73315	49·4	1·9449	89143	54·0	2·1260	106518
44·9	1·7677	73642	49·5	1·9488	89505	54·1	2·1299	106913
45·0	1·7717	73971	49·6	1·9528	89867	54·2	2·1339	107309
45·1	1·7756	74300	49·7	1·9567	90229	54·3	2·1378	107705
45·2	1·7795	74630	49·8	1·9606	90593	54·4	2·1417	108102
45·3	1·7835	74961	49·9	1·9646	90957	54·5	2·1457	108500
45·4	1·7874	75292	50·0	1·9685	91322	54·6	2·1496	108898
45·5	1·7913	75624	50·1	1·9724	91688	54·7	2·1535	109298
45·6	1·7952	75957	50·2	1·9764	92054	54·8	2·1575	109698
45·7	1·7992	76290	50·3	1·9803	92421	54·9	2·1614	110098
45·8	1·8031	76624	50·4	1·9842	92789	55·0	2·1654	110500
45·9	1·8071	76959	50·5	1·9882	93158	55·1	2·1693	110902
46·0	1·8110	77295	50·6	1·9921	93527	55·2	2·1732	111305

TABLE No. 105.—WEIGHT OF LEAD IN LB. PER NAUTICAL MILE—*continued.*

Diameter mm.	Diameter inch	Lb. per nautical mile	Diameter mm.	Diameter inch	Lb. per nautical mile	Diameter mm.	Diameter inch	Lb. per nautical mile
55·3	2·1772	111709	56·9	2·2402	118266	58·5	2·3031	125011
55·4	2·1811	112113	57·0	2·2441	118682	58·6	2·3071	125439
55·5	2·1850	112518	57·1	2·2480	119099	58·7	2·3110	125867
55·6	2·1890	112924	57·2	2·2520	119517	58·8	2·3150	126296
55·7	2·1929	113330	57·3	2·2559	119935	58·9	2·3189	126726
55·8	2·1968	113738	57·4	2·2598	120354	59·0	2·3228	127157
55·9	2·2008	114146	57·5	2·2638	120773	59·1	2·3268	127589
56·0	2·2047	114555	57·6	2·2677	121194	59·2	2·3307	128021
56·1	2·2087	114964	57·7	2·2716	121615	59·3	2·3346	128453
56·2	2·2126	115374	57·8	2·2756	122037	59·4	2·3386	128887
56·3	2·2165	115785	57·9	2·2795	122460	59·5	2·3425	129321
56·4	2·2205	116197	58·0	2·2835	122883	59·6	2·3465	129756
56·5	2·2244	116609	58·1	2·2874	123307	59·7	2·3504	130192
56·6	2·2283	117022	58·2	2·2913	123732	59·8	2·3543	130629
56·7	2·2323	117436	58·3	2·2953	124157	59·9	2·3583	131066
56·8	2·2362	117851	58·4	2·2992	124584	60·0	2·3622	131504

The above weights in lb. per nautical mile, when multiplied
by 0·8673 give lb. per statute mile.
by 0·4929 give lb. per 1000 yards.
by 0·5390 give lb. per kilometre.
by 0·2444 give kilogrammes per kilometre.

CHAPTER IX.

STEEL WIRE ARMOUR.

WHERE cables are to be laid direct in the ground, or in situations where they may be exposed to mechanical injury, they should be armoured with either steel wire or steel tape. The armour should, generally speaking, consist of (1) steel tape, in the case of cable having a diameter over the lead sheath greater than 10 to 12 millimetres (0·4 to 0·47 inch), except when the cable is liable to be subjected to any strain in the longitudinal direction; (2) steel wires, in the case of cable having a diameter over the lead sheath less than 10 to 12 millimetres, and in all cases where the cable is liable to be strained longitudinally.

The cable or core to be wire armoured has to be provided with a bedding of jute yarn, and the armouring wires are generally protected with an overall serving of jute; for armouring lead-covered cables the various layers are applied to the cable in one of the two following orders :—

(a) Tar	or	(b) Tarred jute yarn
Jute yarn		Compound
Tar		Steel wires
Steel wires		Compound
Compound		Tarred jute yarn
Tarred jute yarn		Compound.
Compound		

The servings of jute yarn should be applied in the opposite direction to the lay of the sheathing wires.

Jute yarn servings under the sheathing wires have, owing to the compression, a specific gravity of approximately 0·796 and weigh 2100 lb. per nautical mile of square inch section.

Tarred jute yarn under sheathing wires has a specific gravity of 0·920 and weighs 2430 lb. per nautical mile of square inch section. The weight of tar in tarred jute yarn is approximately 44 per cent. of the total weight, or 80 per cent. of the jute weight.

Table No. 106 gives the increase of diameter due to one layer of various size jute yarn.

TABLE No. 106.—JUTE SERVING UNDER WIRE ARMOUR.

Size of Jute Yarn, i.e. Weight per Nautical Mile	Increase of Diameter per Layer	
	mils	mm.
5 lb.	118	3·00
6 ,,	128	3·25
8 ,,	148	3·75
10 ,,	166	4·20

JUTE SERVING UNDER WIRE ARMOUR.

Let
n = number of sheathing wires
A = diameter of core
B = pitch diameter of sheath wires
d = diameter of sheath wire.

Therefore the area corresponding to the pitch diameter of the sheathing wires is $\frac{\pi}{4}(B^2)$, and the area of the core is equal to $\frac{\pi}{4}(A^2)$.

Therefore the area of the jute serving space is equal to $\frac{\pi}{4}(B^2 - A^2)$, less the areas of those portions of the sheathing wires inside the pitch circle of the sheathing wires; these portions are very approximately semicircles, and therefore their total area is equal to $\frac{\pi}{4}(d^2)\frac{n}{2}$.

Therefore the area of the jute serving space is equal to

$$\frac{\pi}{4}\left(B^2 - A^2 - \frac{n}{2}d^2\right).$$

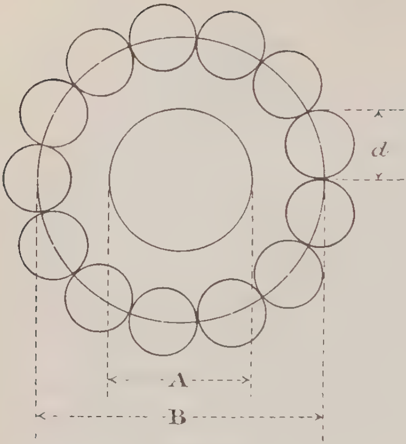


FIG. 10.

Taking the specific gravity of the yarn under wire armour to be 0·796, of tarred jute yarn 0·92, and of cutched jute yarn, as used for submarine cables, 0·626, the constants as given in Table No. 107 are obtained.

By omitting the core in Fig. 10, the jute space becomes

$$\frac{\pi}{4}\left(B^2 - \frac{n}{2}\,d^2\right)$$

but B, the diameter of the pitch circle, is a function of n and d, therefore, the jute space (considering the core as absent) can be expressed in terms of $(n\,d^2)$ and, therefore, also the weight of jute.

TABLE NO. 108.—VALUE OF THE CONSTANT c FOR CALCULATING THE WEIGHT OF JUTE OR HEMP SERVING UNDER STEEL-WIRE SHEATHING, FOR LEAD-SHEATHED CABLES. (1 square inch section weighs 2100 lb. per nautical mile. Specific gravity 0·796.)

No. of Sheath Wires	Constant c for diam. in mm.	Constant c for diam. in inches	No. of Sheath Wires	Constant c for diam. in mm.	Constant c for diam. in inches	No. of Sheath Wires	Constant c for diam. in mm.	Constant c for diam. in inches
3	0·13122	84·643	23	109·333	70534·53	43	424·783	274044
4	·69855	450·66	24	120·228	77563·8	44	446·958	288349
5	1·17665	1139·00	25	131·643	84927·8	45	468·698	302374
6	3·2729	2111·45	26	143·574	92625·3	46	491·010	316769
7	5·4374	3507·89	27	156·025	100647	47	513·855	331507
8	8·0474	5191·71	28	168·994	109024	48	537·233	346589
9	11·175	7209·11	29	182·482	117726	49	561·419	362193
10	14·819	9560·47	30	196·487	126761	50	585·369	377644
11	18·982	12245·80	31	211·011	136131	51	610·956	394151
12	23·662	15265·09	32	226·043	145829	52	635·695	410111
13	28·860	18618·72	33	241·609	155871	53	661·578	426809
14	34·575	22305·81	34	257·687	166244	54	688·034	443876
15	40·809	26327·63	35	274·298	176947	55	714·982	461262
16	47·562	30684·17	36	291·402	187994	56	742·463	478991
17	57·832	35374·17	37	309·039	199373	57	770·418	497025
18	62·621	40398·90	38	327·189	211082	58	799·260	515633
19	70·926	45757·08	39	345·852	223122	59	828·004	534176
20	79·750	51449·99	40	365·027	235493	60	857·537	553229
21	89·094	57477·62	41	384·755	248220			
22	98·951	63838·71	42	404·937	261240			

TABLE No. 107.—CONSTANTS FOR JUTE YARN SERVING.

—	Jute Yarn as used over Lead Sheath and under Wire Armour	Cutched Jute Yarn as used over Gutta-Percha Core, and under Wire Armour	Tarred Jute Yarn as used over Lead Sheath and under Wire Armour
Specific gravity	0·796	0·626	0·920
Weight in lb. per nautical mile per square inch section . .	2100	1650	2430
Weight of jute serving in kilogs. per kilometre when A, B and d given in mm. . . .	$0{\cdot}625\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$0{\cdot}492\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$0{\cdot}722\left(B^2 - A^2 - \frac{n}{2}d^2\right)$
Weight of jute serving in lb. per nautical mile, A, B and d given in mm.	$2{\cdot}56\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$2{\cdot}01\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$2{\cdot}95\left(B^2 - A^2 - \frac{n}{2}d^2\right)$
Weight of jute serving in lb. per nautical mile, A, B and d given in inches	$1650\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$1300\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$1900\left(B^2 - A^2 - \frac{n}{2}d^2\right)$
Weight of jute serving in lb. per statute mile, A, B and d given in inches	$1430\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$1130\left(B^2 - A^2 - \frac{n}{2}d^2\right)$	$1650\left(B^2 - A^2 - \frac{n}{2}d^2\right)$

All serving jute for gutta-percha cores in submarine cables, is cutched by immersing it in a solution of cutch in boiling water; the amount of cutch used is from 5 to 7 per cent. of the jute weight.

The weight of jute serving under wire armour can therefore be written equal to

$$(d^2 c) \text{ lb. per nautical mile,}$$

where d is the diameter of the sheathing wire, and c is a constant depending upon the number of wires and the specific gravity of the jute yarn. The value of this constant c is given in Table No. 108 for 2100 lb. jute and in Table No. 109 for 1650 lb. jute.

The weight of serving in pounds per nautical mile multiplied by 0·2445 gives the weight in kilogrammes per kilometre.

The Engineering Standards Committee recommend that for all cables whose diameter over lead is less than 0·50 inch, the sheathing should consist of steel wires of 0·072 inch diameter; further, that for diameters less than 0·50 inch the thickness of the jute serving should be 60 mils thick, and for diameters above 0·50 inch the thickness of jute serving should be 100 mils thick. The Verband Deutscher Elektrotechniker recommend wire armour for cables up to 10 square millimetres conductor cross section, the armouring wires to be of 1·8 millimetre diameter, both the serving under and over the armour to consist of jute 1·5 millimetre thick.

TABLE No. 109.—VALUE OF CONSTANT c FOR CALCULATING THE WEIGHT OF JUTE OR HEMP SERVING UNDER STEEL WIRE SHEATHING, FOR GUTTA-PERCHA CABLES. (1 square inch section weighs 1650 lb. per nautical mile. Specific gravity = 0·626.)

No. of Sheath Wires	Constant c for diam. in mm.	Constant c for diam. in inches	No. of Sheath Wires	Constant c for diam. in mm.	Constant c for diam. in inches
3	0·10310	66·513	17	43·082	27794
4	·54886	354·09	18	49·202	31742
5	1·3872	894·93	19	55·728	35952
6	2·5715	1659·0	20	62·661	40425
7	4·2723	2756·2	21	70·002	45161
8	6·3230	4079·2	22	77·749	50159
9	8·7800	5667·3	23	85·904	55420
10	11·6437	7511·8	24	94·465	60943
11	14·9142	9621·7	25	103·434	66729
12	18·5914	11994	26	112·809	72777
13	22·676	14629	27	122·591	79088
14	27·166	17526	28	132·781	85662
15	32·065	20686	29	143·379	92499
16	37·370	24109	30	154·383	99598

Tables Nos. 110 and 111 give the weight in lb. per nautical mile of jute yarn, as used under the sheathing wires (specific gravity 0·80) of lead-sheathed cables.

TABLE No. 110.—WEIGHT OF JUTE YARN IN LB. PER NAUTICAL MILE.
(Diameter in millimetres.)

Diam.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
0	0·0000	0·02556	0·10226	0·23008	0·40904	0·63912	0·92033	1·2527	1·6361	2·0707
1	2·5865	3·0933	3·6813	4·3204	5·0107	5·7521	6·5446	7·3882	8·283	9·2289
2	10·226	11·274	12·373	13·524	14·725	15·978	17·282	18·637	20·043	21·500
3	23·008	24·568	26·178	27·840	29·553	31·317	33·132	34·998	36·915	38·884
4	40·904	42·974	45·096	47·269	49·493	51·768	54·095	56·472	58·901	61·381
5	63·912	66·494	69·127	71·811	74·547	77·333	80·171	83·06	86·00	88·991
6	92·03	95·126	98·271	101·47	104·71	108·01	111·36	114·76	118·21	121·71
7	125·27	128·87	132·53	136·23	139·99	143·80	147·66	151·57	155·54	159·55
8	163·61	167·73	171·90	176·12	180·38	184·71	189·08	193·50	197·97	202·50
9	207·07	211·70	216·38	221·11	225·90	230·72	235·60	240·54	245·52	250·56
10	255·65	260·79	265·98	271·23	276·51	281·85	287·24	292·69	298·19	303·73
11	309·33	314·98	320·68	326·43	332·24	338·09	344·00	349·96	355·96	362·02
12	368·13	374·29	380·51	386·77	393·08	399·45	405·87	412·33	418·85	425·42
13	432·04	438·72	445·44	452·21	459·04	465·92	472·84	479·82	486·85	493·94
14	501·07	508·25	515·49	522·77	530·11	537·50	544·94	552·43	559·97	567·56
15	575·21	582·90	590·65	598·44	606·29	614·19	622·14	630·14	638·20	646·30
16	654·46	662·66	670·92	679·23	687·59	696·00	704·46	712·98	721·54	730·16
17	738·82	747·54	756·31	765·13	774·00	782·92	791·89	800·92	809·99	819·12
18	828·30	837·52	846·80	856·14	865·52	874·95	884·44	893·97	903·56	913·20
19	922·89	932·63	942·42	952·26	962·15	972·10	982·1	992·14	1002·2	1012·4
20	1022·6	1032·8	1043·1	1053·5	1063·9	1074·4	1084·9	1095·4	1106·0	1116·7
21	1127·4	1138·2	1149·0	1159·8	1170·8	1181·7	1192·8	1203·8	1214·9	1226·1
22	1237·3	1248·6	1259·9	1271·3	1282·7	1294·2	1305·7	1317·3	1329·0	1340·6
23	1352·4	1364·2	1376·0	1387·9	1399·8	1411·8	1423·8	1435·9	1448·1	1460·3
24	1472·5	1484·8	1497·2	1509·6	1522·0	1534·5	1547·1	1559·7	1572·3	1585·0
25	1597·8	1610·6	1623·5	1636·4	1649·3	1662·3	1675·4	1688·5	1701·7	1714·9
26	1728·2	1741·5	1754·9	1768·3	1781·8	1795·3	1808·9	1822·5	1836·2	1849·9
27	1863·7	1877·5	1891·4	1905·3	1919·3	1933·3	1947·4	1961·6	1975·7	1990·0
28	2004·3	2018·6	2033·0	2047·4	2062·0	2076·5	2091·1	2105·7	2120·4	2135·2
29	2150·0	2164·8	2179·8	2194·7	2209·7	2224·8	2239·9	2255·0	2270·2	2285·5
30	2300·8	2316·2	2331·6	2347·1	2362·6	2378·2	2393·8	2409·4	2425·2	2440·9

TABLE No. 110.—WEIGHT OF JUTE YARN IN LB. PER NAUTICAL MILE—*continued.*
(Diameter in mils.)

Diam.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
31	2457	2473	2489	2505	2521	2537	2553	2569	2585	2602
32	2618	2634	2651	2667	2684	2700	2717	2734	2750	2767
33	2784	2801	2818	2835	2852	2869	2886	2903	2921	2938
34	2955	2973	2990	3008	3025	3043	3061	3078	3096	3114
35	3132	3150	3168	3186	3204	3222	3240	3258	3277	3295
36	3313	3332	3350	3369	3387	3406	3425	3443	3462	3481
37	3500	3519	3538	3557	3576	3595	3614	3634	3653	3672
38	3692	3711	3731	3750	3770	3789	3809	3829	3849	3869
39	3888	3908	3928	3948	3969	3989	4009	4029	4050	4070
40	4090	4111	4131	4152	4173	4193	4214	4235	4256	4277
41	4297	4318	4340	4361	4382	4403	4424	4445	4467	4488
42	4510	4531	4553	4574	4596	4618	4639	4661	4683	4705
43	4727	4749	4771	4793	4815	4838	4860	4882	4904	4927
44	4949	4972	4994	5017	5040	5062	5085	5108	5131	5154
45	5177	5200	5223	5246	5269	5292	5316	5339	5363	5386
46	5410	5433	5457	5480	5504	5528	5552	5575	5599	5623
47	5647	5671	5695	5720	5744	5768	5792	5817	5841	5866
48	5890	5915	5939	5964	5989	6013	6038	6063	6088	6113
49	6138	6163	6188	6213	6239	6264	6289	6315	6340	6366
50	6391	6417	6442	6468	6494	6520	6546	6571	6597	6623
51	6649	6676	6702	6728	6754	6780	6807	6833	6860	6886
52	6913	6939	6966	6993	7019	7046	7073	7100	7127	7154
53	7181	7208	7235	7263	7290	7317	7345	7372	7400	7427
54	7455	7482	7510	7538	7566	7593	7621	7649	7677	7705
55	7733	7766	7790	7818	7846	7875	7903	7931	7960	7989
56	8017	8046	8074	8103	8132	8161	8190	8219	8248	8277
57	8306	8335	8364	8394	8423	8452	8482	8511	8541	8570
58	8600	8630	8659	8689	8719	8749	8779	8809	8839	8869
59	8899	8929	8959	8990	9020	9051	9081	9111	9142	9173
60	9203									

TABLE NO. 111.—WEIGHT OF JUTE YARN IN LB. PER NAUTICAL MILE.

(Diameter in mils.)

Diam.	0	1	2	3	4	5	6	7	8	9
0	0·00000	0·001649	0·006597	0·014844	0·026389	0·041234	0·059376	0·080817	0·105558	0·133596
10	·16493	·19957	·23750	·27874	·32327	·3711	·42223	·47666	·53448	·59541
20	·65973	·72736	·79828	·8725	·95002	1·0308	1·1149	1·2024	1·2931	1·3871
30	1·4844	1·5850	1·6889	1·7961	1·9066	2·0204	2·1375	2·2579	2·3816	2·5086
40	2·6389	2·7725	2·9094	3·0496	3·1931	3·3399	3·490	3·6434	3·800	3·960
50	4·1234	4·2899	4·4598	4·633	4·809	4·989	5·172	5·359	5·548	5·741
60	5·938	6·137	6·340	6·546	6·756	6·968	7·184	7·404	7·627	7·852
70	8·082	8·314	8·550	8·789	9·032	9·278	9·527	9·779	10·035	10·294
80	10·556	10·821	11·090	11·362	11·638	11·916	12·198	12·484	12·772	13·064
90	13·360	13·658	13·960	14·265	14·574	14·885	15·200	15·519	15·840	16·165
100	16·493	16·825	17·160	17·498	17·839	18·184	18·532	18·883	19·238	19·596
110	19·957	20·321	20·689	21·060	21·435	21·812	22·193	22·578	22·965	23·356
120	23·750	24·148	24·549	24·953	25·360	25·770	26·185	26·602	27·023	27·447
130	27·874	28·304	28·738	29·175	29·615	30·059	30·506	30·956	31·410	31·867
140	32·327	32·790	33·257	33·727	34·200	34·677	35·157	35·641	36·127	36·617
150	37·110	37·607	38·106	38·609	39·116	39·625	40·138	40·655	41·174	41·697
160	42·223	42·752	43·285	43·821	44·361	44·903	45·449	45·998	46·551	47·107
170	47·666	48·228	48·794	49·363	49·965	50·511	51·090	51·672	52·258	52·846
180	53·438	54·034	54·633	55·235	55·840	56·449	57·060	57·676	58·294	58·916
190	59·541	60·169	60·801	61·436	62·074	62·716	63·361	64·009	64·660	65·315
200	65·973	66·635	67·300	67·968	68·639	69·313	69·991	70·672	71·357	72·045
210	72·736	73·430	74·128	74·829	75·533	76·241	76·951	77·666	78·383	79·104
220	79·828	80·555	81·286	82·020	82·757	83·498	84·242	84·989	85·739	86·493
230	87·250	88·010	88·774	89·541	90·311	91·085	91·861	92·642	93·425	94·212
240	95·002	95·795	96·592	97·392	98·195	99·001	99·811	100·62	101·44	102·26
250	103·08	103·91	104·74	105·57	106·41	107·25	108·09	108·94	109·79	110·64
260	111·49	112·35	113·22	114·08	114·95	115·82	116·7	117·58	118·46	119·35

TABLE No. 111.—WEIGHT OF JUTE YARN IN LB. PER NAUTICAL MILE—*continued.*
(Diameter in mils.)

Diam.	0	1	2	3	4	5	6	7	8	9
270	120·24	121·13	122·02	122·92	123·83	124·73	125·64	126·55	127·47	128·39
280	129·30	130·23	131·16	132·09	133·03	133·97	134·91	135·85	136·80	137·75
290	138·71	139·67	140·63	141·59	142·56	143·53	144·51	145·49	146·47	147·45
300	148·44	149·43	150·43	151·42	152·42	153·43	154·44	155·45	156·46	157·48
310	158·50	159·52	160·55	161·58	162·62	163·65	164·70	165·74	166·79	167·84
320	168·89	169·95	171·01	172·07	173·14	174·21	175·28	176·36	177·44	178·53
330	179·61	180·70	181·80	182·89	183·99	185·10	186·20	187·31	188·43	189·54
340	190·66	191·79	192·91	194·04	195·18	196·31	197·45	198·59	199·74	200·89
350	202·04	203·20	204·36	205·52	206·69	207·86	209·03	210·21	211·39	212·57
360	213·75	214·94	216·14	217·33	218·53	219·73	220·91	222·15	223·36	224·58
370	225·79	227·02	228·24	229·47	230·70	231·94	233·18	234·42	235·66	236·91
380	238·16	239·42	240·68	241·94	243·20	244·47	245·74	247·02	248·30	249·58
390	250·86	252·15	253·44	254·74	256·04	257·34	258·64	259·95	261·26	262·58
400	263·89	265·21	266·54	267·87	269·20	270·53	271·87	273·21	274·56	275·90
410	277·25	278·61	279·97	281·33	282·69	284·06	285·43	286·80	288·18	289·56
420	290·94	292·33	293·72	295·11	296·51	297·91	299·31	300·72	302·13	303·54
430	304·96	306·38	307·80	309·23	310·66	312·10	313·53	314·97	316·41	317·86
440	319·31	320·76	322·22	323·68	325·14	326·61	328·08	329·55	331·03	332·51
450	333·99	335·48	336·97	338·46	339·95	341·45	342·96	344·46	345·97	347·48
460	349·00	350·52	352·04	353·57	355·09	356·63	358·16	359·70	361·24	362·79
470	364·34	365·89	367·44	369·00	370·57	372·13	373·70	375·27	376·85	378·43
480	380·01	381·59	383·18	384·77	386·37	387·96	389·57	391·17	392·78	394·39
490	396·00	397·62	399·25	400·87	402·50	404·13	405·76	407·40	409·04	410·69
500	412·33									

Galvanised steel sheathing wire has a specific gravity of approximately 7·8.

The weight of any galvanised steel wire is equal to $\frac{d^2}{62 \cdot 6}$ lb. per nautical mile, or $\frac{d^2}{72}$ lb. per statute mile, when d is the diameter of the wire in mils.

The diameter of any galvanised steel wire weighing W lb. per nautical mile is equal to $7 \cdot 91 \sqrt{W}$ mils, or weighing W lb. per statute mile $8 \cdot 49 \sqrt{W}$ mils.

The length of lay for the sheathing wires is given by the diameter under the inner jute serving multiplied by 24.

The number n of sheathing wires having a diameter d which will completely sheathe a cable is equal to

$$n = \pi \left(\frac{D + d}{d} \right)$$

where D is the diameter over the jute serving.

Table No. 112 gives the number and diameter of the wires which will completely sheathe cables of various diameters.

Table No. 113 gives the weight of steel wire in lb. per nautical mile for various diameters.

If a cable be completely armoured by N wires, each of diameter d, then the diameter of the pitch circle of the sheathing wires is given by $(d\,c)$, where c is a constant depending on the number N of sheathing wires. The diameter over the inner jute serving will therefore be equal to $(d\,c - d)$, and the diameter over the sheathing wires will be equal to $(d\,c + d)$.

Table No. 114 gives the value of this constant c for various numbers of sheathing wires.

TABLE No. 112.—NUMBER OF WIRES REQUIRED TO SHEATHE ANY SERVED CABLE.

Diam. of Sheath Wire, mm.	2·0	2·1	2·2	2·3	2·4	2·5	2·6	2·7	2·8	2·9	3·0	3·1	3·2	3·3	3·4	3·5	3·6	3·7	3·8	3·9	4·0
No. of Sheath Wires	Diameter of Cable over the Jute Serving in Millimetres																				
16	8·3	8·7	9·1	9·5	9·9	10·3	10·7	11·1	11·5	12·0	12·4	12·8	13·2	13·6	14·0	14·4	14·8	15·2	15·7	16·1	16·5
17	8·9	9·3	9·8	10·2	10·6	11·1	11·5	12·0	12·4	12·9	13·3	13·7	14·2	14·6	15·0	15·5	15·9	16·4	16·9	17·3	17·7
18	9·5	10·0	10·5	10·9	11·4	11·9	12·4	12·8	13·3	13·8	14·3	14·7	15·2	15·7	16·2	16·6	17·1	17·6	18·1	18·5	19·0
19	10·1	10·6	11·2	11·7	12·2	12·7	13·2	13·7	14·2	14·7	15·2	15·7	16·2	16·7	17·2	17·7	18·3	18·8	19·3	19·8	20·3
20	10·8	11·3	11·8	12·4	12·9	13·5	14·0	14·5	15·1	15·6	16·2	16·7	17·2	17·8	18·3	18·8	19·4	19·9	20·5	21·0	21·6
21	11·4	12·0	12·5	13·1	13·7	14·2	14·8	15·4	16·0	16·5	17·1	17·7	18·2	18·8	19·4	20·0	20·5	21·1	21·7	22·2	22·8
22	12·0	12·6	13·2	13·8	14·4	15·0	15·6	16·2	16·8	17·4	18·0	18·6	19·2	19·8	20·4	21·0	21·6	22·2	22·8	23·4	25·0
23	12·6	13·3	13·9	14·5	15·2	15·8	16·4	17·1	17·7	18·3	19·0	19·6	20·2	20·9	21·5	22·1	22·6	23·4	24·0	24·6	25·3
24	13·3	14·0	14·6	15·3	16·0	16·6	17·3	18·0	18·6	19·3	20·0	20·6	21·3	22·0	22·6	23·3	24·0	24·6	25·3	26·0	26·6
25	13·9	14·6	15·3	16·0	16·7	17·4	18·1	18·8	19·5	20·2	20·9	21·6	22·3	23·0	23·7	24·4	25·1	25·8	26·5	27·2	27·9
26	14·6	15·4	16·0	16·8	17·5	18·2	19·0	19·7	20·4	21·2	21·9	22·6	23·4	24·0	24·8	25·5	26·2	27·0	27·7	28·4	29·2
27	15·2	15·9	16·7	17·5	18·4	19·0	19·8	20·5	21·3	22·0	22·8	23·6	24·3	25·1	25·8	26·6	27·3	28·1	28·8	29·6	30·4
28	15·8	16·6	17·4	18·2	19·0	19·7	20·6	21·4	22·2	22·9	23·7	24·5	25·3	26·1	26·9	27·7	28·5	29·2	30·0	30·9	31·6
29	16·5	17·3	18·1	19·0	19·8	20·6	21·4	22·2	23·1	23·9	24·7	25·5	26·4	27·2	28·0	28·8	29·6	30·4	31·3	32·1	33·0
30	17·1	17·9	18·8	19·7	20·5	21·4	22·2	23·1	24·0	24·8	25·7	26·5	27·4	28·2	29·1	30·0	30·8	31·6	32·5	33·4	34·2
31	17·7	18·6	19·5	20·4	21·3	22·2	23·1	24·0	24·8	25·7	26·6	27·5	28·4	29·2	30·1	31·0	31·9	32·8	33·7	34·6	35·5
32	18·3	19·2	20·2	21·1	22·0	22·9	23·8	24·8	25·7	26·6	27·5	28·4	29·4	30·3	31·2	32·2	33·0	34·0	34·9	35·8	36·8
33	19·0	19·9	20·9	21·9	22·8	23·7	24·7	25·6	26·6	27·6	28·5	29·5	30·4	31·4	32·3	33·2	34·2	35·2	36·1	37·0	38·0
34	19·7	20·6	21·6	22·6	23·6	24·6	25·5	26·5	27·5	28·5	29·5	30·5	31·5	32·4	33·4	34·4	35·4	36·4	37·4	38·4	39·4
35	20·3	21·3	22·3	23·4	24·4	25·4	26·4	27·4	28·4	29·4	30·4	31·5	32·5	33·5	34·5	35·5	36·5	37·6	38·6	39·6	40·6
36	20·9	22·0	23·0	24·1	25·1	26·2	27·2	28·2	29·3	30·3	31·4	32·4	33·4	34·5	35·6	36·6	37·7	38·7	39·7	40·7	41·8

TABLE No. 113.—WEIGHT OF IRON WIRE IN LB. PER NAUTICAL MILE.

(Diameter in mils.)

Diam.	0	1	2	3	4	5	6	7	8	9
0	0·0000	0·015935	0·06374	0·14342	0·25497	0·39839	0·57369	0·78085	1·0199	1·2908
10	1·5936	1·9282	2·2947	2·6931	3·1234	3·5855	4·0795	4·6054	5·1632	5·7528
20	6·3743	7·0277	7·7129	8·4300	9·1790	9·9598	10·772	11·617	12·494	13·402
30	14·342	15·314	16·318	17·354	18·422	19·521	20·653	21·816	23·011	24·238
40	25·497	26·788	28·111	29·465	30·852	32·270	33·720	35·202	36·716	38·262
50	39·839	41·449	43·090	44·763	46·469	48·206	49·974	51·775	53·608	55·472
60	57·369	59·297	61·257	63·249	65·273	67·328	69·416	71·535	73·687	75·870
70	78·085	80·332	82·611	84·921	87·264	89·638	92·045	94·483	96·953	99·455
80	101·99	104·55	107·15	109·78	112·44	115·14	117·86	120·62	123·41	126·23
90	129·08	131·96	134·88	137·83	140·81	143·82	146·86	149·94	153·05	156·19
100	159·36	162·56	165·79	169·06	172·36	175·69	179·05	182·45	185·87	189·33
110	192·82	196·34	199·90	203·48	207·10	210·75	214·43	218·14	221·89	225·67
120	229·47	233·31	237·19	241·09	245·03	249·00	253·00	257·03	261·09	265·19
130	269·31	273·47	277·66	281·89	286·14	290·43	294·75	299·10	303·48	307·89
140	312·34	316·82	321·33	325·87	330·44	335·05	339·69	344·35	349·06	353·79
150	358·55	363·35	368·18	373·04	377·93	382·86	387·81	392·80	397·82	402·87
160	407·95	413·07	418·22	423·40	428·61	433·85	439·12	444·43	449·77	455·14
170	460·34	465·98	471·44	476·94	482·74	488·03	493·62	499·25	504·91	510·60
180	516·32	522·07	527·85	533·67	539·52	545·40	551·31	557·26	563·23	569·24
190	575·3	581·3	587·4	593·6	599·8	606·0	612·2	618·4	624·7	631·1
200	637·4	643·8	650·2	656·7	663·2	669·7	676·2	682·8	689·4	696·1
210	702·8	709·5	716·2	723·0	729·8	736·6	743·5	750·4	757·3	764·3
220	771·3	778·3	785·4	792·5	799·6	806·7	813·9	821·1	828·4	835·7
230	843·0	850·3	857·7	865·1	872·6	880·0	887·6	895·1	902·7	910·3
240	917·9	925·6	933·3	941·0	948·7	956·5	964·4	972·2	980·1	988·0
250	996·0	1004	1012	1020	1028	1036	1044	1052	1061	1069
260	1077	1086	1094	1102	1111	1119	1127	1136	1145	1153

TABLE No. 113.—WEIGHT OF IRON WIRE IN LB. PER NAUTICAL MILE—*continued.*

Diam.	0	1	2	3	4	5	6	7	8	9
270	1162	1170	1179	1188	1196	1205	1214	1223	1232	1240
280	1249	1258	1267	1276	1285	1294	1303	1313	1322	1331
290	1340	1349	1359	1368	1377	1387	1396	1406	1415	1425
300	1434	1444	1453	1463	1473	1482	1492	1502	1512	1522
310	1531	1541	1551	1561	1571	1581	1591	1601	1611	1622
320	1632	1642	1652	1663	1673	1683	1694	1704	1714	1725
330	1735	1746	1756	1767	1778	1788	1799	1810	1821	1831
340	1842	1853	1864	1875	1886	1897	1908	1919	1930	1941
350	1952	1963	1974	1986	1997	2008	2020	2031	2042	2054
360	2065	2077	2088	2100	2111	2123	2135	2146	2158	2170
370	2182	2193	2205	2217	2229	2241	2253	2265	2277	2289
380	2301	2313	2325	2338	2350	2362	2374	2388	2399	2411
390	2424	2436	2449	2461	2474	2486	2499	2512	2524	2537
400	2550	2562	2575	2588	2601	2614	2627	2640	2653	2666
410	2679	2692	2705	2718	2731	2744	2758	2771	2784	2798
420	2811	2824	2838	2851	2865	2878	2892	2905	2919	2933
430	2946	2960	2974	2988	3002	3015	3029	3043	3057	3071
440	3085	3099	3113	3127	3141	3156	3170	3184	3198	3213
450	3227	3241	3256	3270	3285	3299	3314	3328	3343	3357
460	3372	3387	3401	3416	3431	3446	3460	3475	3490	3505
470	3520	3535	3550	3565	3580	3595	3611	3626	3641	3656
480	3672	3687	3702	3718	3733	3748	3764	3779	3795	3811
490	3826	3842	3857	3873	3889	3905	3920	3936	3952	3968
500	3984									

lb. per nautical mile × 0·8673 = lb. per statute mile.
lb. per nautical mile × 0·2445 = kilog. per kilometre.

TABLE No. 114.—TABLE OF CONSTANTS FOR CALCULATING THE PITCH DIAMETER AND DIAMETER OVER SHEATHING WIRES.

Number of Sheath Wires	Constant	Number of Sheath Wires	Constant	Number of Sheath Wires	Constant
3	1·1547	26	8·2962	49	15·6079
4	1·4142	27	8·6138	50	15·9260
5	1·7013	28	8·9314	51	16·2441
6	2·0000	29	9·2491	52	16·5623
7	2·3048	30	9·5668	53	16·8843
8	2·6131	31	9·8845	54	17·1984
9	2·9238	32	10·2023	55	17·5166
10	3·2361	33	10·5200	56	17·8347
11	3·5495	34	10·8387	57	18·1529
12	3·8637	35	11·1558	58	18·4710
13	4·1786	36	11·4737	59	18·7892
14	4·4940	37	11·7862	60	19·1073
15	4·8097	38	12·1096	61	19·4254
16	5·1258	39	12·4275	62	19·7437
17	5·4422	40	12·7455	63	20·0615
18	5·7588	41	13·0635	64	20·3800
19	6·0755	42	13·3815	65	20·6984
20	6·3924	43	13·6995	66	21·0163
21	6·7095	44	14·0175	67	21·3347
22	7·0267	45	14·3356	68	21·6528
23	7·3439	46	14·6537	69	21·9710
24	7·6613	47	14·9717	70	22·2893
25	7·9787	48	15·2898		

Table No. 115 gives the number and diameter of sheathing wires necessary to completely armour jute served cables of various diameters, together with their weight in kilogrammes per kilometre which is equal to:

7·8 (cross section of one wire in mm.^{2}) × (number of wires) + 2 per cent. for lay

Kilogrammes per kilometre × 2·016 gives lb. per 1000 yards.
Kilogrammes per kilometre × 3·548 gives lb. per statute mile.
Kilogrammes per kilometre × 4·090 gives lb. per nautical mile.

Table No. 116 gives particulars of various sheathings as used for submarine cables; the weight of jute serving given is that which would completely fill the space inside the sheathing wires; therefore the weight of the core, considered as jute, must be subtracted from this weight to obtain the amount of serving in the cable. For example:

18 sheathing wires each 10 mm. diameter.
Pitch diameter given 2·267 inches.
Therefore diameter over jute serving = 2·267 − 0·3937 inch.
Let the diameter over the gutta-percha core be 1·48 inch.
Therefore core area = 1·72 square inch.
Therefore the weight of this core, considered as jute, will be 1·72 × 1650 = 2838 lb. per nautical mile.
Therefore the weight of the jute serving required will be 4940 − 2838 = 2102 lb. per nautical mile.

Table No. 115.—Particulars of Round Steel Wire Sheathing for Cables.

Diam. over Jute mm.	Sheath Wires No.	Sheath Wires Diam. mm.	Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires No.	Sheath Wires Diam. mm.	Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires No.	Sheath Wires Diam. mm.	Weight of Wires, kilog. per km.
3·3	10	1·5	141	10·8	20	2·0	500	15·2	27	2·0	675
3·8	11	1·5	155	10·9	26	1·5	366	15·2	19	3·0	1068
4·3	12	1·5	169	10·9	13	3·5	995	15·2	15	4·0	1499
4·4	10	2·0	250	10·9	10	5·0	1562	15·2	11	6·0	2474
4·7	13	1·5	183	11·1	17	2·5	664	15·3	10	7·0	3061
5·0	11	2·0	275	11·3	15	3·0	843	15·5	17	3·5	1301
5·2	14	1·5	197	11·3	11	4·5	1391	15·5	12	5·5	2268
5·5	10	2·5	391	11·4	27	1·5	380	15·6	14	4·5	1770
5·6	12	2·0	300	11·4	21	2·0	525	15·7	36	1·5	506
5·7	15	1·5	211	11·4	12	4·0	1199	15·7	13	5·0	2030
6·1	16	1·5	225	11·9	18	2·5	703	15·8	23	2·5	899
6·3	11	2·5	430	11·9	28	1·5	394	15·8	28	2·0	700
6·3	13	2·0	325	12·0	22	2·0	550	16·2	20	3·0	1124
6·6	17	1·5	239	12·0	10	5·5	1890	16·2	11	6·5	2904
6·6	10	3·0	562	12·1	14	3·5	1071	16·4	10	7·5	3514
6·9	14	2·0	350	12·4	29	1·5	408	16·5	29	2·0	725
7·1	12	2·5	469	12·4	16	3·0	900	16·5	16	4·0	1599
7·1	18	1·5	253	12·5	11	5·0	1717	16·6	24	2·5	938
7·5	11	3·0	619	12·5	13	4·0	1299	16·6	18	3·5	1377
7·6	19	1·5	267	12·6	23	2·0	575	17·0	15	4·5	1897
7·6	15	2·0	375	12·7	19	2·5	743	17·0	12	6·0	2699
7·7	10	3·5	765	12·8	30	1·5	422	17·1	30	2·0	750
7·8	13	2·5	508	12·8	12	4·5	1517	17·1	21	3·0	1181
8·1	20	1·5	281	13·1	10	6·0	2249	17·2	13	5·5	2457
8·3	16	2·0	400	13·3	31	1·5	436	17·4	25	2·5	977
8·5	21	1·5	295	13·3	24	2·0	600	17·4	14	5·0	2186
8·5	12	3·0	675	13·3	17	3·0	956	17·5	10	8·0	3998
8·6	14	2·5	545	13·3	15	3·5	1148	17·5	11	7·0	3367
8·7	11	3·5	842	13·5	20	2·5	782	17·7	31	2·0	775
8·7	10	4·0	1000	13·8	32	1·5	450	17·7	19	3·5	1454
8·9	17	2·0	425	13·8	14	4·0	1399	17·7	17	4·0	1699
9·0	22	1·5	310	13·8	11	5·5	2079	18·0	22	3·0	1237
9·4	15	2·5	586	13·9	25	2·0	625	18·2	26	2·5	1016
9·4	13	3·0	731	14·1	13	4·5	1644	18·3	32	2·0	800
9·5	23	1·5	324	14·2	21	2·5	821	18·3	12	6·5	3168
9·5	18	2·0	450	14·2	12	5·0	1873	18·5	16	4·5	2023
9·8	10	4·5	1265	14·2	10	6·5	2640	18·7	10	8·5	4514
9·9	12	3·5	918	14·3	33	1·5	464	18·8	20	3·5	1531
10·0	24	1·5	338	14·3	18	3·0	1012	18·9	13	6·0	2924
10·0	11	4·0	1099	14·4	16	3·5	1224	19·0	33	2·0	825
10·1	19	2·0	475	14·6	26	2·0	650	19·0	27	2·5	1055
10·3	16	2·5	625	14·7	34	1·5	478	19·0	23	3·0	1293
10·4	25	1·5	352	15·0	22	2·5	860	19·0	18	4·0	1799
10·4	14	3·0	787	15·2	35	1·5	492	19·0	15	5·0	2344

TABLE No. 115—*continued.*

Diam. over Jute mm.	Sheath Wires		Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires		Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires		Weight of Wires, kilog. per km.
	No.	Diam. mm.			No.	Diam. mm.			No.	Diam. mm.	
19·0	14	5·5	2646	23·7	28	3·0	1574	28·5	18	6·0	4048
19·0	11	7·5	3865	23·8	11	9·5	6202	28·6	16	7·0	4897
19·7	34	2·0	850	24·0	12	8·0	5416	28·7	17	6·5	4488
19·7	10	9·0	5060	24·1	20	4·5	2509	28·8	29	3·5	2219
19·7	28	2·5	1094	24·2	17	5·5	3213	29·2	26	4·0	2599
19·8	12	7·0	3673	24·2	14	7·0	4285	29·5	34	3·0	1911
19·9	17	4·5	2150	24·4	25	3·5	1913	29·5	14	8·5	6319
20·0	24	3·0	1349	24·5	16	6·0	3598	29·5	20	5·5	3780
20·0	21	3·5	1607	24·5	15	6·5	3960	29·9	13	9·5	7330
20·2	11	8·0	4398	24·6	34	2·5	1328	29·9	24	4·5	3035
20·3	35	2·0	875	24·7	29	3·0	1620	30·0	30	3·5	2295
20·3	19	4·0	1899	25·0	13	8·0	5198	30·0	22	5·0	3434
20·3	13	6·5	3432	25·0	11	10·0	6872	30·2	15	8·0	5998
20·5	16	5·0	2498	25·0	22	4·0	2199	30·2	19	6·0	4273
20·6	29	2·5	1133	25·1	19	5·0	2966	30·4	35	3·0	1967
20·8	10	9·5	5639	25·3	23	4·0	2299	30·4	27	4·0	2699
20·8	15	5·5	2835	25·4	35	2·5	1367	30·8	18	6·5	4752
20·9	36	2·0	900	25·5	12	9·0	6072	30·8	16	7·5	5622
20·9	25	3·0	1405	25·5	26	3·5	1989	30·9	17	7·0	5204
20·9	14	6·0	3148	25·6	21	4·5	2656	31·0	31	3·5	2372
21·0	22	3·5	1683	25·7	30	3·0	1686	31·2	14	9·0	7084
21·2	12	7·5	4217	26·0	18	5·5	3402	31·2	21	5·5	3968
21·3	11	8·5	4965	26·0	14	7·5	4919	31·4	36	3·0	2024
21·3	18	4·5	2276	26·2	36	2·5	1406	31·4	25	4·5	3161
21·4	30	2·5	1172	26·5	17	6·0	3823	31·5	13	10·0	8120
21·6	20	4·0	1999	26·5	15	7·0	4591	31·6	28	4·0	2799
21·9	10	10·0	6247	26·6	31	3·0	1743	31·6	23	5·0	3591
21·9	26	3·0	1462	26·6	27	3·5	2066	32·1	15	8·5	6770
21·9	13	7·0	3979	26·6	24	4·0	2399	32·2	32	3·5	2448
22·0	17	5·0	2654	26·6	16	6·5	4223	32·2	20	6·0	4498
22·1	23	3·5	1760	26·7	13	8·5	5868	32·7	16	8·0	6398
22·2	31	2·5	1211	26·8	12	9·5	6766	32·7	26	4·5	3288
22·5	11	9·0	5565	26·8	20	5·0	3123	32·9	19	6·5	5016
22·5	16	5·5	3024	27·0	22	4·5	2782	33·0	14	9·5	7894
22·5	14	6·5	3696	27·5	32	3·0	1799	33·0	29	4·0	2899
22·6	12	8·0	4798	27·5	19	5·5	3591	33·0	22	5·5	4158
22·6	19	4·5	2403	27·7	14	8·0	5598	33·1	17	7·5	5974
22·7	15	6·0	3374	27·7	28	3·5	2142	33·2	33	3·5	2525
22·8	27	3·0	1518	27·9	25	4·0	2499	33·2	24	5·0	3747
22·8	21	4·0	2099	28·2	13	9·0	6578	33·2	18	7·0	5510
22·9	32	2·5	1250	28·2	12	10·0	7496	34·0	15	9·0	7590
23·3	24	3·5	1836	28·3	15	7·5	5271	34·2	30	4·0	2999
23·5	13	7·5	4568	28·4	21	5·0	3279	34·2	21	6·0	4723
23·6	18	5·0	2810	28·5	33	3·0	1855	34·3	27	4·5	3414
23·7	33	2·5	1289	28·5	23	4·5	2908	34·4	34	3·5	2602

TABLE NO. 115—*continued.*

Diam. over Jute mm.	Sheath Wires No.	Sheath Wires Diam. mm.	Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires No.	Sheath Wires Diam. mm.	Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires No.	Sheath Wires Diam. mm.	Weight of Wires, kilog. per km.
34·7	14	10·0	8744	41·1	32	4·5	4046	49·4	29	6·0	6522
34·7	23	5·5	4347	41·2	29	5·0	4527	49·4	27	6·5	7128
34·8	25	5·0	3903	41·8	36	4·0	3599	49·8	24	7·5	8432
34·9	16	8·5	7222	41·9	25	6·0	5623	50·2	19	10·0	11870
35·0	20	6·5	5279	42·0	27	5·5	5103	50·5	32	5·5	6047
35·3	17	8·0	6798	42·0	22	7·0	6734	50·5	23	8·0	9196
35·3	19	7·0	5805	42·1	17	9·5	9586	50·8	35	5·0	5464
35·5	35	3·5	2678	42·6	21	7·5	7378	51·0	22	8·5	9930
35·5	31	4·0	3099	42·7	19	8·5	8576	51·0	20	9·5	11275
35·5	18	7·5	6365	42·8	30	5·0	4684	51·1	26	7·0	7958
35·7	28	4·5	3541	43·0	33	4·5	4172	51·2	30	6·0	6748
36·0	15	9·5	8458	43·0	20	8·0	7998	51·2	21	9·0	10630
36·0	22	6·0	4948	43·0	18	9·0	9108	51·4	28	6·5	7392
36·4	26	5·0	4059	43·2	24	6·5	6335	52·1	25	7·5	8785
36·5	24	5·5	4536	43·5	28	5·5	5292	52·3	36	5·0	5620
36·6	36	3·5	2754	43·8	26	6·0	5847	52·6	33	5·5	6237
36·8	32	4·0	3199	44·2	34	4·5	4299	53·1	27	7·0	8264
37·0	16	9·0	8096	44·3	23	7·0	7040	53·2	31	6·0	6972
37·0	29	4·5	3667	44·4	17	10·0	10620	53·2	24	8·0	9596
37·0	21	6·5	5544	44·5	31	5·0	4880	53·5	29	6·5	7656
37·6	17	8·5	7673	45·0	22	7·5	7730	53·8	20	10·0	12490
37·6	20	7·0	6122	45·2	19	9·0	9614	54·0	34	5·5	6425
37·8	15	10·0	9370	45·3	18	9·5	10148	54·0	23	8·5	10380
38·0	33	4·0	3299	45·3	29	5·5	5481	54·0	22	9·0	11300
38·0	18	8·0	7198	45·3	25	6·5	6600	54·0	21	9·5	11840
38·0	23	6·0	5173	45·5	21	8·0	8398	54·7	26	7·5	9136
38·0	27	5·0	4215	45·6	27	6·0	6072	55·0	32	6·0	7196
38·0	19	7·5	6676	45·7	20	8·5	9026	55·3	28	7·0	8570
38·1	25	5·5	4725	45·9	35	4·5	4426	55·6	25	8·0	9996
38·5	30	4·5	3794	46·0	32	5·0	4995	55·7	30	6·5	7920
39·0	16	9·5	9022	46·5	24	7·0	7346	55·8	35	5·5	6614
39·0	22	6·5	5808	47·0	30	5·5	5670	56·5	24	8·5	10830
39·4	34	4·0	3399	47·4	36	4·5	4552	56·8	21	10·0	13120
39·5	28	5·0	4371	47·4	18	10·0	11240	57·0	23	9·0	11640
39·8	17	9·0	8602	47·5	28	6·0	6 97	57·0	22	9·5	12405
39·8	21	7·0	6428	47·5	26	6·5	6864	57·1	27	7·5	9488
40·0	31	4·5	3920	47·5	23	7·5	8082	57·2	33	6·0	7422
40·0	26	5·5	4914	47·7	19	9·5	10710	57·5	36	5·5	6804
40·0	24	6·0	5398	48·0	22	8·0	8796	57·5	29	7·0	8876
40·3	20	7·5	7028	48·1	33	5·0	5152	57·7	31	6·5	8184
40·4	18	8·5	8124	48·2	20	9·0	10120	58·2	26	8·0	10395
40·5	19	8·0	7598	48·3	21	8·5	9478	59·0	34	6·0	7647
40·6	35	4·0	3499	48·6	25	7·0	7652	59·3	25	8·5	11280
41·0	16	10·0	9994	48·7	31	5·5	5859	59·5	28	7·5	9839
41·0	23	6·5	6071	49·2	34	5·0	5308	59·6	32	6·5	8447

TABLE No. 115—*continued.*

Diam. over Jute m.m.	Sheath Wires — No.	Sheath Wires — Diam. mm.	Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires — No.	Sheath Wires — Diam. mm.	Weight of Wires, kilog. per km.	Diam. over Jute mm.	Sheath Wires — No.	Sheath Wires — Diam. mm.	Weight of Wires, kilog. per km.
59·9	24	9·0	12140	68·3	27	9·0	13660	79·0	28	10·0	17490
60·0	30	7·0	9182	68·5	30	8·0	11995	80·0	31	9·0	15685
60·0	22	10·0	13740	68·7	32	7·5	11240	81·0	33	8·5	14890
60·2	23	9·5	12965	69·0	34	7·0	10410	81·5	35	8·0	13995
61·0	35	6·0	7872	69·4	26	9·5	14660	81·5	30	9·5	16915
61·0	27	8·0	10795	69·6	25	10·0	15610	82·5	29	10·0	18110
61·7	29	7·5	10190	70·5	29	8·5	13090	83·0	32	9·0	16190
62·0	31	7·0	9489	71·0	31	8·0	12395	83·5	34	8·5	15345
62·0	26	8·5	11730	71·0	33	7·5	11592	84·0	36	8·0	14395
62·1	33	6·5	8710	71·0	28	9·0	14170	84·4	31	9·5	17480
62·8	25	9·0	12650	71·5	35	7·0	10710	85·5	32	9·5	18040
63·0	36	6·0	8096	72·1	27	9·5	15222	86·0	35	8·5	15795
63·1	24	9·5	13530	73·0	30	8·5	13540	86·0	33	9·0	16700
63·3	28	8·0	11195	73·0	26	10·0	16240	86·0	30	10·0	18740
63·5	34	6·5	8976	73·3	36	7·0	11020	88·2	31	9·0	17200
63·5	23	10·0	14360	73·5	34	7·5	11950	89·0	36	8·5	16250
64·3	30	7·5	10540	73·6	32	8·0	12795	89·0	31	10·0	19360
64·5	32	7·0	9796	74·4	29	9·0	14670	90·5	33	9·5	18605
64·5	27	8·5	12185	75·0	28	9·5	15790	90·5	32	10·0	19985
65·6	26	9·0	13160	75·5	31	8·5	13990	91·0	35	9·0	17710
65·9	29	8·0	11595	76·0	33	8·0	13195	93·1	34	9·5	19170
66·0	35	6·5	9239	76·0	27	10·0	16860	91·0	36	9·0	18220
66·1	25	9·5	14095	76·5	35	7·5	12300	95·0	33	10·0	20610
66·5	33	7·0	10100	77·1	30	9·0	15180	96·9	35	9·5	19732
66·5	24	10·0	14990	78·1	32	8·5	14410	98·2	34	10·0	21235
66·7	31	7·5	10890	78·5	34	8·0	13595	99·2	36	9·5	20298
67·0	28	8·5	12640	78·5	36	7·5	12650	100·8	35	10·0	21860
68·0	36	6·5	9504	78·5	29	9·5	16350	104·8	36	10·0	22185

TABLE No. 116. PARTICULARS OF STEEL WIRE ARMOURING FOR SUBMARINE CABLE.

(Jute serving weighing 1650 lb. per sq. in. per nautical mile.)

Diam. of Wire mm.	Diam. of Wire in.	No. of Wires	Pitch Diam. of Wires mm.	Pitch Diam. of Wires in.	Weight of a Single Wire, lb. per Nautical Mile	Total Weight of Wires, lb. per Nautical Mile	Total Weight of Jute inclosed, lb. per Nautical Mile
10·0	0·3937	8	26·15	1·029	2474 + 4½ %	20683	650
„	„	9	29·25	1·151	„	23268	880
„	„	10	32·4	1·274	„	25803	1163
„	„	11	35·5	1·397	„	28438	1509
„	„	12	38·65	1·521	„	31024	1856
„	„	13	41·8	1·645	„	33600	2225
„	„	14	44·95	1·769	„	36194	2730
„	„	15	48·1	1·893	„	38879	3200
„	„	16	51·26	2·018	„	41365	3750
„	„	17	54·4	2·142	„	43950	4300
„	„	18	57·6	2·267	„	46535	4940
8·0	0·3150	8	20·9	0·823	1581·25 + 4½ %	13219	420
„	„	9	23·4	0·921	„	14871	570
„	„	10	25·9	1·019	„	16521	745
„	„	11	28·4	1·118	„	18174	955
„	„	12	30·9	1·217	„	19828	1189
„	„	13	33·42	1·316	„	21480	1450
„	„	14	35·95	1·415	„	23142	1740
„	„	15	38·5	1·515	„	24784	2050
„	„	16	41·0	1·614	„	26437	2350
„	„	17	43·55	1·714	„	28088	2720
„	„	18	46·1	1·814	„	29741	3110
6·0	0·2362	8	15·66	0·6172	887·5 + 4 %	7384	230
„	„	9	17·56	0·6906	„	8306	315
„	„	10	19·4	0·7643	„	9230	419
„	„	11	21·3	0·8383	„	10152	537
„	„	12	23·2	0·9126	„	11080	670
„	„	13	25·07	0·9870	„	11998	815
„	„	14	26·95	1·061	„	12922	979
„	„	15	28·87	1·136	„	13844	1130
„	„	16	30·8	1·211	„	14768	1290
„	„	17	32·61	1·285	„	15690	1525
„	„	18	34·55	1·360	„	16613	1750
„	„	19	36·45	1·435	„	17536	1980
„	„	20	38·4	1·510	„	18460	2220
„	„	21	40·28	1·585	„	19382	2485
„	„	22	42·18	1·660	„	20306	2790
„	„	23	44·5	1·753	„	21228	3150
„	„	24	45·95	1·809	„	22154	3395

TABLE NO. 116.—*continued.*

Diam. of Wire mm.	Diam. of Wire in.	No. of Wires	Pitch Diam. of Wires mm.	Pitch Diam. of Wires in.	Weight of a Single Wire, lb. per Nautical Mile	Total Weight of Wire, lb. per Nautical Mile	Total Weight of Jute inclosed, lb. per Nautical Mile
5·0	0·1969	8	13·08	0·5145	618·5 + 4%	5146	160
,,	,,	9	14·64	·5757	,,	5789	224
,,	,,	10	16·20	·6372	,,	6432	290
,,	,,	11	17·74	·6988	,,	7075	375
,,	,,	12	19·36	·7607	,,	7719	464
,,	,,	13	20·90	·8227	,,	8362	570
,,	,,	14	22·47	·8848	,,	9005	679
,,	,,	15	24·10	·9470	,,	9648	800
,,	,,	16	25·65	1·009	,,	10292	930
,,	,,	17	27·20	1·071	,,	10934	1070
,,	,,	18	28·80	1·133	,,	11578	1215
,,	,,	19	30·40	1·196	,,	12221	1400
,,	,,	20	32·00	1·258	,,	12864	1568
,,	,,	21	33·60	1·321	,,	13498	1740
,,	,,	22	35·15	1·383	,,	14151	1910
,,	,,	23	36·75	1·446	,,	14794	2150
,,	,,	24	38·30	1·508	,,	15438	2350
4·0	0·1575	8	10·45	0·4116	393 + 3%	3238	104
,,	,,	9	11·70	·4605	,,	3643	141
,,	,,	10	12·93	·5096	,,	4048	186
,,	,,	11	14·20	·5590	,,	4453	238
,,	,,	12	15·45	·6085	,,	4858	297
,,	,,	13	16·72	·6581	,,	5264	363
,,	,,	14	18·00	·7078	,,	5667	434
,,	,,	15	19·25	·7575	,,	6073	514
,,	,,	16	20·50	·8073	,,	6477	597
,,	,,	17	21·75	·8571	,,	6881	688
,,	,,	18	23·05	·9070	,,	7286	779
,,	,,	19	24·30	·9569	,,	7691	872
,,	,,	20	25·58	1·0068	,,	8096	985
,,	,,	21	26·80	1·0567	,,	8501	1126
,,	,,	22	28·10	1·106	,,	8905	1253
,,	,,	23	29·40	1·156	,,	9310	1392
,,	,,	24	30·65	1·206	,,	9715	1520
3·5	0·1378	8	9·2	0·3601	303·5 + 3%	2501	77
,,	,,	9	10·23	·4029	,,	2813	107
,,	,,	10	11·33	·4459	,,	3126	141
,,	,,	11	12·42	·4891	,,	3439	180
,,	,,	12	13·52	·5324	,,	3751	223
,,	,,	13	14·62	·5758	,,	4065	275
,,	,,	14	15·72	·6193	,,	4397	332
,,	,,	15	16·82	·6628	,,	4689	393

TABLE No. 116.—*continued.*

Diam. of Wire		No. of Wires	Pitch Diam. of Wires		Weight of a Single Wire, lb. per Nautical Mile	Total Weight of Wire, lb. per Nautical Mile	Total Weight of Jute inclosed, lb. per Nautical Mile
mm.	in.		mm.	in.			
3·5	0·1378	16	17·93	0·7063	303·5 + 3 %	5002	457
,,	,,	17	19·02	·7490	,,	5314	524
,,	,,	18	20·14	·7935	,,	5627	597
,,	,,	19	21·26	·8372	,,	5939	680
,,	,,	20	22·40	·8808	,,	6252	766
,,	,,	21	23·50	·9245	,,	6564	852
,,	,,	22	24·60	·9682	,,	6877	948
,,	,,	23	25·43	1·0119	,,	7189	1043
,,	,,	24	26·80	1·0557	,,	7504	1164
3·0	0·1181	8	7·84	0·3086	222 + 3 %	1829	57
,,	,,	9	8·77	·3453	,,	2058	79
,,	,,	10	9·71	·3822	,,	2287	105
,,	,,	11	10·62	·4192	,,	2515	134
,,	,,	12	11·60	·4563	,,	2744	167
,,	,,	13	12·52	·4935	,,	2972	204
,,	,,	14	13·50	·5307	,,	3201	244
,,	,,	15	14·43	·5680	,,	3430	289
,,	,,	16	15·40	·6053	,,	3658	336
,,	,,	17	16·32	·6427	,,	3887	387
,,	,,	18	17·30	·6801	,,	4116	443
,,	,,	19	18·22	·7175	,,	4345	501
,,	,,	20	19·20	·7549	,,	4573	565
,,	,,	21	20·12	·7924	,,	4802	628
,,	,,	22	21·08	·8298	,,	5030	700
,,	,,	23	22·00	·8672	,,	5260	790
,,	,,	24	23·00	·9049	,,	5488	850
2·5	0·09843	8	6·54	0·2572	153·1 + 3 %	1262	48
,,	,,	9	7·31	·2878	,,	1419	65
,,	,,	10	8·09	·3185	,,	1577	75
,,	,,	11	8·88	·3494	,,	1734	95
,,	,,	12	9·66	·3803	,,	1892	116
,,	,,	13	10·46	·4131	,,	2050	143
,,	,,	14	11·25	·4423	,,	2207	170
,,	,,	15	12·00	·4734	,,	2365	201
,,	,,	16	12·80	·5045	,,	2522	233
,,	,,	17	13·60	·5357	,,	2680	265
,,	,,	18	14·40	·5668	,,	2837	308
,,	,,	19	15·20	·5980	,,	2995	349
,,	,,	20	16·00	·6292	,,	3154	393
,,	,,	21	16·80	·6604	,,	3311	438
,,	,,	22	17·60	·6916	,,	3469	486
,,	,,	23	18·35	·7229	,,	3627	538
,,	,,	24	19·15	·7541	,,	3784	591

TABLE No. 116.—*continued.*

Diam. of Wire		No. of Wires	Pitch Diam. of Wires		Weight of a Single Wire, lb. per Nautical Mile	Total Weight of Wire, lb. per Nautical Mile	Total Weight of Jute inclosed, lb. per Nautical Mile
mm.	in.		mm.	in.			
2·0	0·07874	8	5·23	0·2057	99·5 + 3 %	820	26
,,	,,	9	5·85	·2302	,,	922	36
,,	,,	10	6·47	·2548	,,	1025	47
,,	,,	11	7·10	·2795	,,	1127	60
,,	,,	12	7·73	·3044	,,	1230	74
,,	,,	13	8·36	·3290	,,	1332	89
,,	,,	14	8·99	·3538	,,	1435	108
,,	,,	15	9·62	·3787	,,	1537	130
,,	,,	16	10·23	·4035	,,	1640	150
,,	,,	17	10·90	·4285	,,	1742	173
,,	,,	18	11·50	·4534	,,	1845	197
,,	,,	19	12·15	·4784	,,	1947	223
,,	,,	20	12·80	·5033	,,	2050	250
,,	,,	21	13·40	·5283	,,	2152	281
,,	,,	22	14·05	·5533	,,	2255	313
,,	,,	23	14·70	·5783	,,	2357	344
,,	,,	24	15·32	·6032	,,	2460	378
1·75	0·06890	8	4·57	0·1800	74·75 + 3 %	624	20
,,	,,	9	5·12	·2014	,,	703	26
,,	,,	10	5·67	·2230	,,	780	36
,,	,,	11	6·21	·2445	,,	858	45
,,	,,	12	6·76	·2662	,,	936	57
,,	,,	13	7·31	·2879	,,	1014	70
,,	,,	14	7·87	·3096	,,	1092	83
,,	,,	15	8·42	·3314	,,	1170	98
,,	,,	16	8·97	·3532	,,	1248	114
,,	,,	17	9·53	·3750	,,	1327	133
,,	,,	18	10·10	·3968	,,	1404	151
,,	,,	19	10·60	·4186	,,	1482	172
,,	,,	20	11·20	·4404	,,	1560	192
,,	,,	21	11·75	·4623	,,	1639	213
,,	,,	22	12·30	·4841	,,	1716	237
,,	,,	23	12·85	·5060	,,	1795	262
,,	,,	24	13·40	·5279	,,	2097	290
1·5	0·05906	8	3·92	0·1543	55·5 + 3 %	457	15
,,	,,	9	4·39	·1727	,,	514	20
,,	,,	10	4·85	·1910	,,	572	27
,,	,,	11	5·32	·2094	,,	628	34
,,	,,	12	5·80	·2282	,,	686	42
,,	,,	13	6·27	·2468	,,	744	52
,,	,,	14	6·74	·2654	,,	800	61
,,	,,	15	7·22	·2841	,,	857	72

TABLE No. 116.—*continued.*

Diam. of Wire mm.	Diam. of Wire in.	No. of Wires	Pitch Diam. of Wires mm.	Pitch Diam. of Wires in.	Weight of a Single Wire, lb. per Nautical Mile	Total Weight of Wire, lb. per Nautical Mile	Total Weight of Jute inclosed, lb. per Nautical Mile
1·5	0·05906	16	7·69	0·3027	55·5 + 3%	915	84
,,	,,	17	8·17	·3214	,,	971	97
,,	,,	18	8·64	·3401	,,	1029	111
,,	,,	19	9·12	·3588	,,	1085	126
,,	,,	20	9·59	·3775	,,	1143	141
,,	,,	21	10·05	·3963	,,	1200	158
,,	,,	22	10·55	·4150	,,	1258	175
,,	,,	23	11·00	·4337	,,	1314	193
,,	,,	24	11·50	·4525	,,	1372	211

The heavier steel wires used for sheathing submarine cables are compounded before application to the cable: the wire is moderately heated and then dipped into a mixture of 4 parts of pitch to 1 part of resin oil. The wire takes up approximately 4 per cent. of its weight of the compound.

The efficiency of the zinc coating on galvanised iron or steel wires is generally tested by dipping a piece of the wire four times into a concentrated solution of copper sulphate, the wire being wiped dry after each dip; if the galvanisation is complete there will be no deposition of copper on the wire, although the surface of the zinc may become slightly blackened.

Table No. 117 gives some particulars of heavy wire armour, such as is applied to coast submarine cables. The armour consists of a layer of steel wire strands.

TABLE No. 117.—PARTICULARS OF STRAND WIRE ARMOUR FOR SHORE-END CABLES.

Number and Size of Wire Strands. Diam. in inches	Total Weight of Jute inclosed, lb. per nautical mile (1650 lb. per sq. in. per nautical mile)	Diam. inside Sheathing available for reception of core, inches	Diam. over Sheathing, inches
12 × 3 × 0·230	2838	1·270	2·375
12 × 3 × ·220	2715	1·214	2·272
12 × 3 × ·210	2591	1·159	2·168
12 × 3 × ·200	2468	1·104	2·065
11 × 3 × ·230	2277	1·131	2·221
11 × 3 × ·220	2178	1·081	2·125
11 × 3 × ·210	2079	1·032	2·028
11 × 3 × ·200	1980	0·983	1·931
10 × 3 × ·230	1778	·992	2·068
10 × 3 × ·220	1700	·948	1·979
10 × 3 × ·210	1623	·905	1·888
10 × 3 × ·200	1546	·862	1·798

Flexible Spiral Armour.

Cables requiring partial mechanical protection and maximum flexibility, are armoured with a single galvanised steel wire applied to form an open helix round the cable with a comparatively short length of lay.

Let D = diameter under armour in millimetres.
d = diameter of the armour wire in millimetres.
l = length of lay in millimetres.
s = space between the successive turns in millimetres.
x = length of wire per turn in millimetres.

Then, in Fig. 11, if A B is made equal to the pitch circumference $\pi(D + d)$,

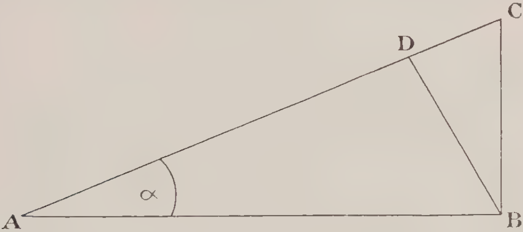


Fig. 11.

and B C equal to the length of lay l, then A C will be equal to the length of wire x, and the perpendicular B D will be equal to $(d + s)$;

therefore $$x = \sqrt{\{\pi(D + d)\}^2 + l^2}$$

therefore the ratio between the length of wire and the length of cable will be

$$\frac{x}{l} = \operatorname{cosec} \alpha = \frac{\sqrt{\{\pi(D + d)\}^2 + l^2}}{l} = \frac{\pi(D + d)}{d + s}$$

The weight of steel wire in kilogrammes per kilometre is equal to

$$7 \cdot 8 \text{ (area of wire in square millimetres)} = \frac{7 \cdot 8\, \pi}{4} . d^2$$

Therefore the weight of steel wire in kilogrammes per kilometre of cable is equal to

$$6 \cdot 13\, d^2 \operatorname{cosec} \alpha$$

and the weight of wire in lb. per statute mile of cable is equal to

$$21 \cdot 7\, d^2 \operatorname{cosec} \alpha$$

Example.—
Diameter of cable = D = 0·362 in.
Diameter of steel wire d = 0·064 in. = 1·626 mm.
Space between wire to be $\frac{1}{4}$ in.

$$\operatorname{Cosec} \alpha = \frac{\pi(D + d)}{d + s} = \frac{\pi(0 \cdot 362 + 0 \cdot 064)}{0 \cdot 064 + 0 \cdot 250} = 4 \cdot 262$$

therefore the weight of wire in lb. per statute mile is equal to

$$21{\cdot}7 \times (1{\cdot}626)^2 \times 4{\cdot}262 = 245$$

or again:—

Diameter of cable = D = 0·566 in.
Diameter of steel wire = d = 0·036 in. = 0·9144 mm.
Required, 6 turns per in.

therefore the length of lay $l = \frac{1}{6} = 0{\cdot}167$ in.

$$\text{Cosec } \alpha = \frac{\sqrt{\{\pi(D+d)\}^2 + l^2}}{l} = 11{\cdot}9$$

therefore the weight of wire in lb. per statute mile is equal to

$$21{\cdot}7 \times (0{\cdot}9144)^2 \times 11{\cdot}9 = 216$$

Segmental or Facon Strip Armour.

The usual sizes of steel segmental strip are given in Table No. 118, together with their weight and approximate price.

Table No. 118.—Segmental Strip.

Dimensions in millimetres			Weight in kilogrammes per kilometre	Approximate Price
Length, outer side	Length, inner side	Thickness		
4·0	3·4	1·4	41·21	25 shillings per 100 kilogrammes, or 11/4 per 100 lb.
4·9	4·3	1·7	62·22	
6·2	5·0	1·7	75·74	
6·6	6·1	3·0	151·56	
8·4	7·9	3·0	194·52	

The weight of armour in kilogrammes per kilometre is equal to the mean cross section of the strip in square millimetres multiplied by the number of strips multiplied by 7·8. A further 2 per cent. must be added for the lay.

Table No. 119 gives particulars of segmental strip armour for cables of various diameters.

Telephone cables for drawing-in systems are often "open" armoured; the lead-sheathed cable is served with jute in the usual manner and then sheathed with half the number of segmental strips which would completely armour the cable; for draw-in systems the armour is left bright, that is, no serving is applied over the armouring wires.

TABLE No. 119.—SEGMENTAL STEEL ARMOUR.

Diam. over Jute, mm.	Segmental Wires		Weight of Sheath in kilog. per km.	Diam. over Jute, mm.	Segmental Wires		Weight of Sheath in kilog. per km.
	No.	Dimensions, mm.			No.	Dimensions, mm.	
6·3	6	4·0×3·4×1·4	248	34·3	23	4·9×4·3×1·7	1431
7·6	7	4·0×3·4×1·4	289	35·8	24	4·9×4·3×1·7	1494
9·6	8	4·0×3·4×1·4	330	36·0	19	6·2×5·0×1·7	1439
10·1	9	4·0×3·4×1·4	371	37·3	25	4·9×4·3×1·7	1556
11·3	10	4·0×3·4×1·4	412	37·8	20	6·2×5·0×1·7	1515
12·6	11	4·0×3·4×1·4	454	39·0	26	4·9×4·3×1·7	1618
13·9	12	4·0×3·4×1·4	495	39·8	21	6·2×5·0×1·7	1591
13·9	10	4·9×4·3×1·7	622	40·6	27	4·9×4·3×1·7	1681
15·2	13	4·0×3·4×1·4	536	41·8	22	6·2×5·0×1·7	1666
15·5	11	4·9×4·3×1·7	685	42·1	28	4·9×4·3×1·7	1743
16·5	14	4·0×3·4×1·4	577	43·6	29	4·9×4·3×1·7	1805
17·1	12	4·9×4·3×1·7	747	43·8	23	6·2×5·0×1·7	1742
17·7	15	4·0×3·4×1·4	619	45·3	30	4·9×4·3×1·7	1867
18·1	10	6·2×5·0×1·7	758	45·8	24	6·2×5·0×1·7	1818
18·7	13	4·9×4·3×1·7	809	46·8	31	4·9×4·3×1·7	1929
20·2	11	6·2×5·0×1·7	833	47·8	25	6·2×5·0×1·7	1894
20·2	14	4·9×4·3×1·7	872	48·3	32	4·9×4·3×1·7	1992
21·8	15	4·9×4·3×1·7	934	49·6	26	6·2×5·0×1·7	1969
22·0	12	6·2×5·0×1·7	909	49·9	33	4·9×4·3×1·7	2054
23·3	16	4·9×4·3×1·7	996	51·5	34	4·9×4·3×1·7	2116
24·0	13	6·2×5·0×1·7	985	51·6	27	6·2×5·0×1·7	2045
24·8	17	4·9×4·3×1·7	1058	53·1	35	4·9×4·3×1·7	2178
26·0	14	6·2×5·0×1·7	1061	53·6	28	6·2×5·0×1·7	2121
26·4	18	4·9×4·3×1·7	1120	54·5	36	4·9×4·3×1·7	2240
28·0	19	4·9×4·3×1·7	1183	55·6	29	6·2×5·0×1·7	2197
28·0	15	6·2×5·0×1·7	1136	57·5	30	6·2×5·0×1·7	2273
29·6	20	4·9×4·3×1·7	1245	59·5	31	6·2×5·0×1·7	2348
30·0	16	6·2×5·0×1·7	1212	61·5	32	6·2×5·0×1·7	2424
31·1	21	4·9×4·3×1·7	1307	63·5	33	6·2×5·0×1·7	2500
32·0	17	6·2×5·0×1·7	1288	65·5	34	6·2×5·0×1·7	2576
32·8	22	4·9×4·3×1·7	1369	67·5	35	6·2×5·0×1·7	2651
34·0	18	6·2×5·0×1·7	1364	69·5	36	6·2×5·0×1·7	2727

Jute Serving Between Two Wire Sheaths.

In Fig. 12 let the outer sheath consist of p wires each of diameter a, and let

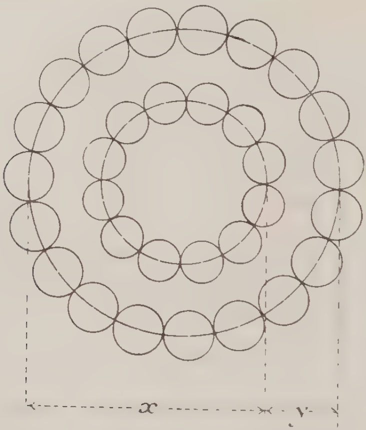


Fig. 12.

the inner sheath consist of q wires each of diameter b, then the section of jute serving between the two sheaths will be

$$\frac{\pi}{4}(x+y)^2 - \frac{\pi}{4}(x-y)^2 - \frac{\pi}{4} \cdot \frac{p}{2} \cdot a^2 - \frac{\pi}{4} \cdot \frac{q}{2} \cdot b^2$$

$$= \frac{\pi}{4}\left(4xy - \frac{p}{2} \cdot a^2 - \frac{q}{2} \cdot b^2\right) = \pi\left(xy - \frac{p a^2 + q b^2}{8}\right)$$

The specific gravity of jute yarn compressed between two rings of sheath wires is 0·625, and weighs 1650 lb. per nautical mile per square inch section.

If the dimensions a, b, x and y are given in inches the weight of jute yarn is given by

$$5184\left(xy - \frac{p a^2 + q b^2}{8}\right) = \text{lb. per nautical mile;}$$

or if the dimensions are given in millimetres, the weight of jute yarn is given by

$$8 \cdot 03\left(xy - \frac{p a^2 + q b^2}{8}\right) = \text{lb. per nautical mile;}$$

or

$$1 \cdot 964\left(xy - \frac{p a^2 + q b^2}{8}\right) = \text{kilogrammes per kilometre.}$$

Serving Over Sheathing Wires.

Let D be the pitch diameter of the sheathing wires (Fig. 13), and D_1 the overall diameter of the cable, and d the diameter of the sheathing wires; then the sectional area of the outside jute serving is

$$\frac{\pi}{4} D_1^2 - \frac{\pi}{4} D^2 - \frac{n}{2} \cdot \frac{\pi}{4} \cdot d^2 = \frac{\pi}{4}\left(D_1^2 - D^2 - \frac{n}{2} d^2\right).$$

The specific gravity of jute as outer serving of a cable is 0·417, therefore, the weight of jute is given by

when D_1, D and d in inches,

$$864\left(D_1^2 - D^2 - \frac{n}{2} d^2\right) = \text{lb. per nautical mile;}$$

when D_1, D and d in millimetres

$$1 \cdot 34\left(D_1^2 - D^2 - \frac{n}{2} d^2\right) = \text{lb. per nautical mile;}$$

$$0 \cdot 3275\left(D_1^2 - D^2 - \frac{n}{2} d^2\right) = \text{kilogrammes per kilometre.}$$

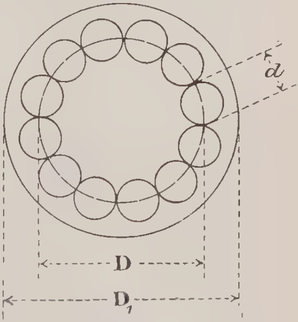


Fig. 13.

The weight of such jute is 1100 lb. per nautical mile per square inch section.

The outer serving over the sheathing wires generally consists of 5 lb. jute yarn, which increases the diameter of the cable by 3·2 millimetres (125 mils) per layer. If D be the diameter over the sheathing wires in inches, then the weight of jute yarn is approximately equal to

$$\frac{\pi}{4}\left\{(D + 0 \cdot 125)^2 - D^2\right\} 1100$$

$$= (D + 0 \cdot 0625)\, 216 = 216\, D + 13 \cdot 5 \text{ lb. per nautical mile for one layer.}$$

The weight for two layers is equal to

$$(D + 0 \cdot 125)\, 432 = 432\, D + 54 \text{ lb. per nautical mile.}$$

If the diameter D is given in millimetres, the weight is equal to

$$8 \cdot 503\, (D + 1 \cdot 59) \text{ lb. per nautical mile for one layer}$$

and

$$17 \cdot 006\, (D + 3 \cdot 18) \text{ lb. per nautical mile for two layers.}$$

TABLE No. 120.—HEMP SERVING.

Description of Serving	Thickness of Serving, mils	Increase of Diameter, mils	Weight of Serving in lb. per Nautical Mile (where D is the diameter over the Sheathing Wires in inches)
1 layer 3-ply 10 lb. Russian hemp	83	166	332 D + 28
„ „ 8 „ „	74	148	296 D + 22
„ „ 6 „ „	64	128	256 D + 16
„ „ 5 „ „	59	118	236 D + 14
2 layers 3-ply 10 lb. Russian hemp	166	332	664 D + 112
„ „ 8 „ „	148	296	592 D + 88
„ „ 6 „ „	128	256	512 D + 64
„ „ 5 „ „	118	236	472 D + 56

Jute yarn servings absorb 80 per cent. of their weight of tar; the weight of compound taken up is equal to the weight of tar.

In the case of submarine cables served with tarred yarn and compounded after each operation, the weight of compound taken up is taken as: for 1 layer of jute and 2 layers of compound, 210 per cent. of the jute weight; for 2 layers of jute and 3 layers of compound, 280 per cent. of the jute weight.

The compound consists of 4 parts of pitch to 1 part of gas tar.

Table No. 121 gives the approximate price of galvanised steel wire.

Table No. 122 gives the approximate prices of various sheathing materials.

The breaking strain of galvanised steel wire is approximately as follows:

Diameter 0·080 inch and smaller .	70 to 75 tons per square inch
Diameter 0·110/0·130 inch . .	55 tons per square inch
Diameter 0·130/0·165 inch . .	50 tons per square inch
Larger diameters	28 to 30 tons per square inch.

Let d = diameter of wire in inches

w = breaking strain of the wire in lb.

and W = breaking strain of the wire in tons per square inch

then

$$W = \frac{w}{\frac{\pi}{4} d^2 \, 2240}$$

Table No. 123 gives the value of the divisor $\frac{\pi}{4} d^2 \, 2240$ for various diameters.

If the diameter d be expressed in millimetres, then

$$W = \frac{w \, 645 \cdot 16}{\frac{\pi}{4} d^2 \, 2240}$$

Table No. 124 gives the value of the divisor

$$\frac{\frac{\pi}{4} d^2 \, 2240}{645 \cdot 16}$$

for various diameters.

TABLE No. 121.—PRICE OF GALVANISED STEEL WIRE.

(Approximate.)

L.S.W.G.	Diameter of Wire		Price in Shillings per	
	inch	millimetre	100 lb.	100 kilogrammes
6	0·192	4·877	8·17	18·0
7	·176	4·470	8·17	18·0
8	·160	4·064	8·40	18·5
9	·144	3·658	8·64	19·0
10	·128	3·251	8·85	19·5
11	·116	2·946	9·32	20·5
12	·104	2·642	10·0	22·0
13	·092	2·337	10·4	23·0
14	·080	2·032	11·1	24·5
15	·072	1·829	11·8	26·0
16	·064	1·626	12·5	27·5
17	·056	1·422	13·4	29·5
18	·048	1·219	13·95	30·75
19	·040	1·016	15·3	53·75
20	·036	0·9144	16·65	36·75

TABLE No. 122.—APPROXIMATE PRICES OF SHEATHING MATERIALS.

Material	Price in Shillings per	
	100 lb.	100 kilogrammes
Jute 5 to 10 lb.	15·9 to 17·0	35 to 37·5
Cutch	27·2	60·0
Gas tar	2·01	4·43
Pitch	1·82	4·0
Resin oil	5·58	12·3
Ozokerit	35·7	78·6
Stockholm tar	8·04	17·7
Archangel tar	5·35	11·8
Compound (4 of pitch to 1 of gas tar)	1·86	4·1
Compound (4 of pitch to 1 of resin oil)	2·60	5·74
Compound (4 of pitch to 1 of Stockholm tar)	3·10	6·83
Compound (4 of pitch to 1 of Archangel tar)	2·53	5·58
Compound (3 of ozokerit to 1 of Stockholm tar)	28·8	63·5
Segmental steel wires	11·36	25·0

Table No. 123.—Tensile Stress of Wires.

Value of the divisor $\frac{\pi}{4}d^2\ 2240$ for diameters expressed in inches.

Diam.	0	1	2	3	4	5	6	7	8	9
0·00	..	0·00176	0·00704	0·01583	0·02815	0·04398	0·06333	0·08621	0·1126	0·1425
·01	0·1759	0·2129	0·2533	0·2973	0·3448	0·3958	0·4504	0·5084	0·5700	0·6351
·02	0·7037	0·7758	0·8515	0·9307	1·013	1·099	1·189	1·283	1·379	1·480
·03	1·583	1·782	1·802	1·916	2·043	2·155	2·281	2·189	2·540	2·676
·04	2·815	2·957	3·103	3·253	3·406	3·563	3·723	3·886	4·053	1·224
·05	4·398	4·576	4·757	4·942	5·130	5·322	5·517	5·716	5·918	6·124
·06	6·333	6·546	6·763	6·983	7·206	7·433	7·664	7·898	8·135	8·376
·07	8·621	8·869	9·120	9·375	9·634	9·896	10·16	10·43	10·70	10·98
·08	11·26	11·54	11·83	12·12	12·41	12·71	13·01	13·32	13·62	13·94
·09	14·25	14·57	14·89	15·22	15·55	15·88	16·21	16·55	16·90	17·24
·10	17·59	17·95	18·30	18·66	19·03	19·40	19·77	20·14	20·52	20·90
·11	21·29	21·68	22·07	22·46	22·86	23·27	23·67	24·08	24·50	24·91
·12	25·33	25·76	26·18	26·62	27·05	27·49	27·93	28·38	28·82	29·28
·13	29·73	30·19	30·65	31·12	31·59	32·06	32·54	33·02	33·50	33·99
·14	34·48	34·98	35·17	35·98	36·48	36·99	37·50	38·02	38·54	39·06
·15	39·58	40·11	40·65	41·18	41·72	42·27	42·81	43·36	43·92	44·48
·16	45·04	45·60	46·17	46·74	47·32	47·90	48·18	49·06	49·65	50·25
·17	50·84	51·44	52·05	52·65	53·26	53·88	54·50	55·12	55·74	56·37
·18	57·00	57·64	58·27	58·92	59·56	60·21	60·86	61·52	62·18	62·81
·19	63·51	64·18	64·85	65·53	66·21	66·90	67·58	68·28	68·97	69·67
·20	70·37	71·08	71·79	72·50	73·21	73·93	74·66	75·38	76·11	76·85
·21	77·58	78·32	79·07	79·82	80·57	81·32	82·08	82·84	83·61	84·38
·22	85·15	85·93	86·71	87·49	88·27	89·06	89·86	90·65	91·45	92·26
·23	93·07	93·88	94·69	95·51	96·33	97·16	97·98	98·82	99·65	100·5
·24	101·3	102·2	103·0	103·9	104·7	105·6	106·5	107·3	108·2	109·1
·25	110·0	110·8	111·7	112·6	113·5	114·4	115·3	116·2	117·1	118·0

TABLE NO. 123.—*continued.*

Diam.	0	1	2	3	4	5	6	7	8	9
0·26	118·9	119·8	120·8	121·7	122·6	123·5	124·5	125·4	126·4	127·3
·27	128·3	129·2	130·2	131·1	132·1	133·0	134·0	135·0	136·0	136·9
·28	137·9	138·9	139·9	140·9	141·9	142·9	143·9	144·9	145·9	146·9
·29	148·0	149·0	150·0	151·0	152·1	153·1	154·1	155·2	156·2	157·3
·30	158·3	159·4	160·5	161·5	162·6	163·7	164·7	165·8	166·9	168·0
·31	169·1	170·2	171·3	172·4	173·5	174·6	175·7	176·8	177·9	179·0
·32	180·2	181·3	182·4	183·5	184·7	185·8	187·0	188·1	189·3	190·4
·33	191·6	192·7	193·9	195·1	196·3	197·4	198·6	199·8	201·0	202·2
·34	203·4	204·6	205·8	207·0	208·2	209·4	210·6	211·8	213·1	214·3
·35	215·5	216·7	218·0	219·2	220·5	221·7	223·0	224·2	225·5	226·7
·36	228·0	229·3	230·5	231·8	233·1	234·4	235·7	237·0	238·3	239·5
·37	240·8	242·2	243·5	244·8	246·1	247·4	248·7	250·0	251·4	252·7
·38	254·0	255·4	256·7	258·1	259·4	260·8	262·1	263·5	264·9	266·2
·39	267·6	269·0	270·3	271·7	273·1	274·5	275·9	277·3	278·7	280·1
·40	281·5	282·9	284·3	285·7	287·1	288·6	290·0	291·4	292·9	294·3
·41	295·7	297·2	298·6	300·1	301·5	303·0	304·5	305·9	307·4	308·9
·42	310·3	311·8	313·3	314·8	316·3	317·8	319·3	320·8	322·3	323·8
·43	325·3	326·8	328·3	329·8	331·4	332·9	334·4	336·0	337·5	339·1
·44	340·6	342·1	343·7	345·3	346·8	348·4	350·0	351·5	353·1	354·7
·45	356·3	357·8	359·4	361·0	362·6	364·2	365·8	367·4	369·0	370·6
·46	372·3	373·9	375·5	377·1	378·8	380·4	382·0	383·7	385·3	387·0
·47	388·6	390·3	391·9	393·6	395·3	396·9	398·6	400·3	402·0	403·7
·48	405·3	407·0	408·7	410·4	412·1	413·8	415·5	417·2	419·0	420·7
·49	422·4	424·1	425·9	427·6	429·3	431·1	432·8	434·6	436·3	438·1
·50	439·8									

TABLE NO. 124.—TENSILE STRENGTH OF WIRES.

Value of the divisor $\dfrac{\frac{\pi}{4} d^2\, 2240}{645 \cdot 16}$ for diameters expressed in millimetres.

Diam.	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
0	..	0·02727	0·10908	0·2454	0·4363	0·6817	0·9817	1·336	1·745	2·209
1	2·727	3·300	3·927	4·609	5·343	6·134	6·979	7·881	8·836	9·845
2	10·91	12·03	13·20	14·43	15·71	17·01	18·43	19·88	21·38	22·93
3	24·54	26·21	27·92	29·70	31·52	33·41	35·34	37·33	39·38	41·48
4	43·63	45·84	48·10	50·42	52·79	55·22	57·70	60·24	62·83	65·48
5	68·18	70·93	73·74	76·60	79·52	82·49	85·52	88·60	91·74	91·93
6	98·17	101·5	104·8	108·2	111·7	115·2	118·8	122·4	126·1	129·8
7	133·6	137·5	141·4	145·3	149·3	153·4	157·5	161·7	165·9	170·2
8	174·5	178·9	183·4	187·9	192·4	197·0	201·7	206·4	211·2	216·0
9	220·9	225·8	230·8	235·9	241·0	246·1	251·3	256·6	261·9	267·3
10	272·7	278·3	283·7	289·3	295·0	300·7	306·4	312·2	318·1	324·0
11	330·0	336·0	342·1	348·2	354·4	360·6	366·9	373·3	379·7	386·2
12	392·7	..	..	..	..	..	..	..	..	..

The tensile strength of yarns is generally expressed per lb. of weight per nautical mile; the average values are:—

Jute	4 lb. strength per 1 lb. weight.		
Italian hemp . . .	10 to 12 lb.	"	"
Russian hemp . . .	8 lb.	"	"
White manila . . .	12 lb.	"	"
Tarred manila . . .	10 lb.	"	"

thus, a 5 lb. jute yarn (i.e. weighing 5 lb. per nautical mile) should have a tensile strength of 5×4 lb. $= 20$ lb.

CHAPTER X.

STEEL TAPE ARMOUR.

Cables having a diameter of less than 10 to 12 mm. (0·4 to 0·47 inch) should not be armoured with steel tapes, but with steel wires.

The cable to be armoured is first served with a layer of 10 lb. jute yarn, which increases the diameter of the cable by 4 mm., and then lapped with two layers of steel tape, applied so as to break joint one with the other, each tape forming an open spiral round the cable, with a gap between the convolutions of generally one-seventh of the width of the tape. The cable is finally served with a layer of 8 lb. jute yarn, which increases the diameter of the cable by another 4 mm. Between each operation the cable is thoroughly saturated with boiled gas tar, and finally run through a compound consisting of 4 parts of pitch to 1 part of gas tar. The complete armour, therefore, increases the diameter of any cable by approximately 12 mm., that is, 4 mm. for each serving, and approximately 4 mm. for the two layers of steel tape. Some makers serve the cable with tarred jute yarn, and compound the cable between each operation. By this method the diameter of the cable is increased by 16 to 18 mm. by the complete armour.

On the Continent it is the usual practice to lap the cable immediately over the lead sheath with one layer of paper, the cable being tarred over the lead sheath and over the paper. This layer of paper has proved to be very effectual in protecting the lead sheath from the action of ammonia and other corroding substances, which percolate through the earth on all roads with considerable horse traffic, especially near cab ranks, etc.

This layer of paper increases the diameter of the cable by only 0·5 mm., and costs approximately 40*s*. per 100 kilogrammes, or 18·2*s*. per 100 lb. The weight of paper in kilogrammes per kilometre is given by:—

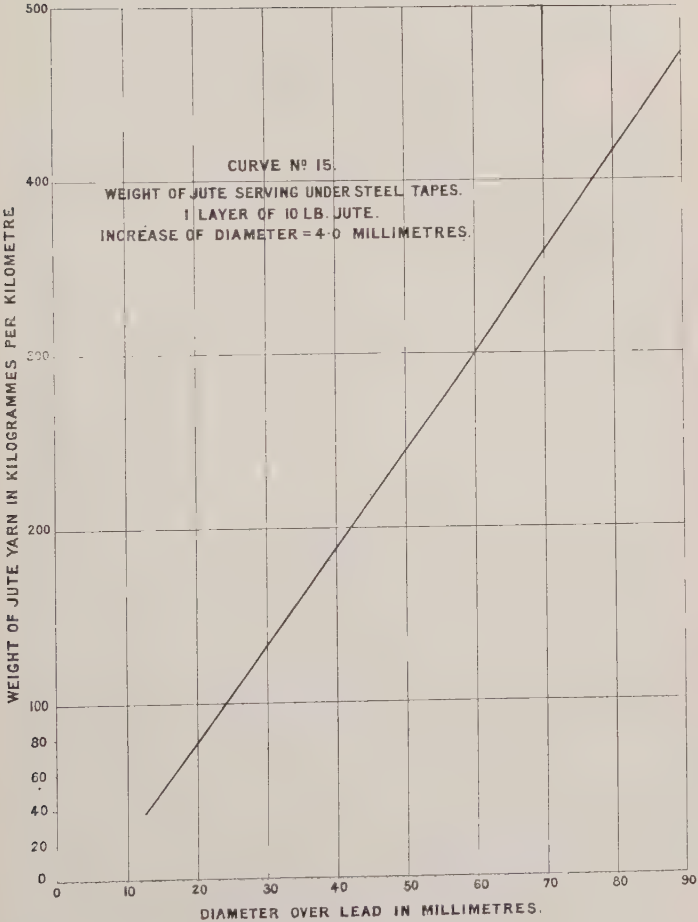
$$\text{Diameter over lead in millimetres} \times 0\cdot 6 = \text{weight of paper.}$$

The jute serving under the steel tapes generally consists of one layer of 10 lb. jute yarn, which increases the diameter of the cable by approximately 4 mm. Curve No. 15 shows the weight of such a serving for cables of various diameters.

The jute serving over the steel tapes generally consists of one layer of 8 lb. jute yarn, which also increases the diameter of the cable by 4 mm. Curve No. 16 shows the weight of such a serving for cables of various diameters.

The weight of steel tape required for any cable is given by multiplying the pitch diameter of the cable by a constant depending on the thickness of the steel tape. The pitch diameter of a cable is equal to the diameter over the lead sheath, plus 4 mm. for one layer of 10 lb. jute yarn, plus twice the thickness of the steel tape.

Provided that an equal percentual gap is allowed for all sizes of steel tape, the width has no effect upon the weight of the tapes.


CURVE Nº 15.
WEIGHT OF JUTE SERVING UNDER STEEL TAPES.
1 LAYER OF 10 LB. JUTE.
INCREASE OF DIAMETER = 4·0 MILLIMETRES.
WEIGHT OF JUTE YARN IN KILOGRAMMES PER KILOMETRE
500
400
300
200
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
DIAMETER OVER LEAD IN MILLIMETRES.

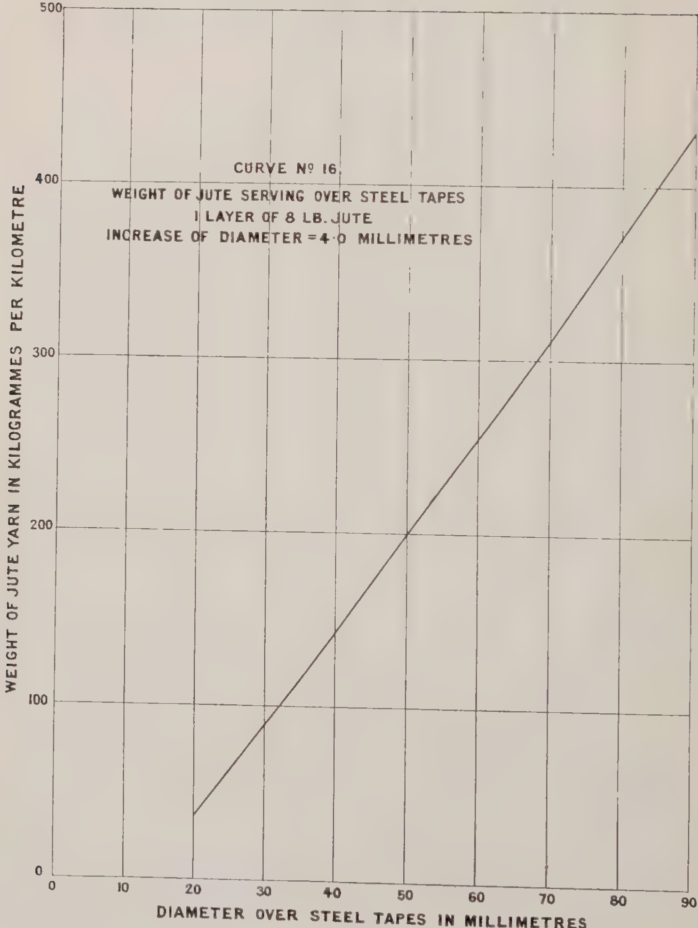

CURVE Nº 16.
WEIGHT OF JUTE SERVING OVER STEEL TAPES
1 LAYER OF 8 LB. JUTE
INCREASE OF DIAMETER = 4·0 MILLIMETRES
WEIGHT OF JUTE YARN IN KILOGRAMMES PER KILOMETRE
0
100
200
300
400
500
0
10
20
30
40
50
60
70
80
90
DIAMETER OVER STEEL TAPES IN MILLIMETRES

TABLE No. 125.—DETAILS OF STEEL TAPE ARMOUR.

Diameter of Cable over Lead Sheath, mm.	Steel Tape Used		Length of Lay. in.	Weight of Steel Tape in Lb. per Nautical Mile	
	Width, in.	Thickness, in.		Mean Pitch Circumference in mm. multiplied by the following Constant	Pitch Diameter in mm. multiplied by the following Constant
43·1 to 60	2·0	0·0495	2·4375	69·20	217·40
32·1 43	1·5	·044	1·75	61·51	193·24
23·1 32	1·25	·0392	1·5	54·80	172·20
16 23	1·0	·0349	1·0	48·79	153·30
Special	1·0	·036	..	50·33	158·10
Special	0·75	·036	..	50·33	158·10

Table No. 126 gives the sizes and particulars of steel tapes usually used by Continental cable manufacturers; the constants given, multiplied by the pitch diameter of the cable in millimetres, gives the weight of steel tape in kilogrammes per kilometre.

TABLE No. 126.—DETAILS OF STEEL TAPE ARMOUR.

Diameter of Cable over Lead Sheath	Dimensions of Steel Tapes		Weight Constant
	Width	Thickness	
mm.	mm.	mm.	
10·0 to 13·8	20	0·5	21·50
13·9 16·0	20	0·8	34·40
16·1 23·0	25	0·9	38·63
23·1 32·0	33	0·9	38·63
32·1 43·0	43	1·0	42·96
Larger than 43·1	55	1·1	46·20
Special	..	0·6	25·36
"	..	1·2	50·4
"	..	1·3	54·9
"	..	1·42	60·2
"	..	1·5	63·9
"	..	1·6	68·6

Another method of calculating the weight of steel tape armour is as follows:—

Let A and a = sectional areas in square mm. corresponding to the diameters over and under the steel tape respectively. As the tapes are applied with a gap of one seventh of the tape width, the sectional area of the steel tape will be $\frac{7}{8}(A - a)$ square mm. Therefore the weight of steel tape in kilog. per kilometre will be $\frac{7 \cdot 8 \times 7\,(A - a)}{8} = 6 \cdot 825\,(A - a)$.

The areas A and a can be obtained from Table No. 60, page 137.

For example:—Let diameter over lead = 40·0 mm., then diameter under steel tapes = 40 + 4 = 44 mm., and diameter over steel tapes = 44 + 4 = 48 mm., therefore the weight of steel tapes is equal to 6·825 (1809·6 − 1520·5) = 1973 kilog. per kilometre.

By the "weight constant" method:—

Diameter over lead sheath . .	=	40·0
1 layer 10 lb. jute yarn . .	=	4·0
2 thicknesses of 43 × 1·0 mm. tape	=	2·0
Therefore pitch diameter of tape	=	46·0

The weight constant for 1·0 mm. tape is 42·96. Therefore the weight of steel tape is equal to 42·96 × 46·0 = 1976 kilogrammes per kilometre.

Lacquered Steel Tape.—When lacquered steel tape armouring is required, the tapes are dipped into a compound consisting of 3 parts of cable pitch to 1 part of resin oil; the steel tape takes up approximately 4 per cent. of its weight of the compound.

The jute serving over the steel tapes generally consists of one layer of 8 lb. jute yarn, which increases the diameter of the cable by 4 mm. Its weight is approximately equal to the weight of the 10 lb. jute serving under the steel tapes.

Before each operation (*i.e.*, paper lapping, serving, tape armouring and final serving), the cable is well saturated with boiled gas tar: the weight of tar taken up by the cable is approximately equal to 80 per cent. of the total jute weight. The tar must be efficiently boiled, as the crude tar contains ammonia and other substances which will corrode the steel tape, the rust from which will in turn corrode the lead sheathing.

The cable is finally compounded with a mixture of 4 parts by weight of pitch to 1 part of gas tar. The weight of compound taken up by the cable is 50 per cent. of the weight of tar, that is to say, 40 per cent. of the total jute serving weight.

TABLE No. 127.—PARTICULARS OF STEEL TAPE ARMOUR FOR LEAD-COVERED CABLES UP TO 700 VOLTS WORKING. (Recommended by the Verband Deutscher Elektrotechniker.)

Section of Conductor, sq. mm.	Jute Serving, Thickness in mm.	Steel Tape Armour, Thickness in mm.	Serving over Armour, Thickness in mm.	Overall Diameter in mm.	
				Without Test Wire	With Test Wire
Up to 10	1·5	Wire Armour	1·5	..	..
16	2·0	2 × 0·5	2·0	23	24
25	2·0	2 × 0·5	2·0	24	25
35	2·0	2 × 0·8	2·0	25	26
50	2·0	2 × 0·8	2·0	29	30
70	2·0	2 × 0·8	2·0	31	32
95	2·0	2 × 0·8	2·0	32	33
120	2·0	2 × 1·0	2·0	35	36
150	2·0	2 × 1·0	2·0	37	38
185	2·5	2 × 1·0	2·0	40	41
240	2·5	2 × 1·0	2·0	43	44
310	2·5	2 × 1·0	2·0	46	47
400	2·5	2 × 1·0	2·0	49	50
500	3·0	2 × 1·0	2·0	54	55
625	3·0	2 × 1·0	2·0	58	59
800	3·0	2 × 1·0	2·0	63	64
1000	3·0	2 × 1·0	2·0	67	68

The Engineering Standards Committee have issued the following recommendations with regard to steel tape armour :—

That cables of less than 0·5 inch (12·7 mm.) diameter over the lead sheath be wire armoured and not tape armoured.

That the following thicknesses of steel tape be used :—

Cables of diameter over lead sheath	from 0·50 to 1·0 inch	30 mils
" " " "	1·01 to 2·0	40 "
" " " "	above 2·0	60 "

The cable to be armoured with two such tapes in all cases.

That jute servings in all cases be 100 mils thick.

Tables Nos. 127 and 128 show the thicknesses and particulars of the recommendations of the Verband Deutscher Elektrotechniker with regard to steel tape armour.

TABLE No. 128.—PARTICULARS OF STEEL TAPE ARMOUR. (Recommendations of the Verband Deutscher Elektrotechniker.)

Diameter under Lead Sheath, mm.	Thickness of Jute Serving in mm.	Thickness of Steel Tape in mm.	Diameter under Lead Sheath, mm.	Thickness of Jute Serving in mm.	Thickness of Steel Tape in mm.
10	2·0	2 × 0·8	38	3·0	2 × 1·0
12	2·0	2 × 0·8	41	3·0	2 × 1·0
14	2·0	2 × 0·8	44	3·0	2 × 1·0
16	2·0	2 × 0·8	47	3·0	2 × 1·0
18	2·0	2 × 0·8	50	3·0	2 × 1·0
20	2·5	2 × 1·0	54	3·0	2 × 1·0
23	2·5	2 × 1·0	58	3·0	2 × 1·0
26	2·5	2 × 1·0	62	3·0	2 × 1·0
29	2·5	2 × 1·0	66	3·0	2 × 1·0
32	2·5	2 × 1·0	70	3·0	2 × 1·0
35	2·5	2 × 1·0			

Table No. 129 gives the weights and prices of steel tape armour for cables of various diameters over lead sheath, based upon the following prices :—

Paper	@ 40/– per 100 kilogrammes
Jute	41/– " "
Steel tape . . .	18/– " "
Tar	6·6/– " "
Compound . . .	6·3/– " "

Waste at 2·5 per cent. of material.

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
10·0	6	2·4	32	13·12	20×0·5	323	58·14	32	13·12
10·1	6	2·4	32	13·12	20×0·5	325	58·50	32	13·12
10·2	7	2·8	33	13·53	20×0·5	327	58·86	33	13·53
10·3	7	2·8	33	13·53	20×0·5	329	59·22	33	13·53
10·4	7	2·8	33	13·53	20×0·5	332	59·76	33	13·53
10·5	7	2·8	34	13·94	20×0·5	334	60·12	34	13·94
10·6	7	2·8	34	13·94	20×0·5	336	60·48	34	13·94
10·7	7	2·8	34	13·94	20×0·5	338	60·84	34	13·94
10·8	7	2·8	34	13·94	20×0·5	340	61·20	34	13·94
10·9	7	2·8	34	13·94	20×0·5	342	61·56	34	13·94
11·0	7	2·8	35	14·35	20×0·5	344	61·92	35	14·35
11·1	7	2·8	35	14·35	20×0·5	346	62·28	35	14·35
11·2	7	2·8	35	14·35	20×0·5	349	62·82	35	14·35
11·3	7	2·8	35	14·35	20×0·5	351	63·18	35	14·35
11·4	7	2·8	36	14·76	20×0·5	353	63·54	36	14·76
11·5	7	2·8	36	14·76	20×0·5	355	63·90	36	14·76
11·6	7	2·8	36	14·76	20×0·5	357	64·26	36	14·76
11·7	8	3·20	36	14·76	20×0·5	359	64·62	36	14·76
11·8	8	3·20	37	15·17	20×0·5	362	65·16	37	15·17
11·9	8	3·20	37	15·17	20×0·5	364	65·52	37	15·17
12·0	8	3·20	37	15·17	20×0·5	366	65·88	37	15·17
12·1	8	3·20	37	15·17	20×0·5	368	66·24	37	15·17
12·2	8	3·20	38	15·58	20×0·5	370	66·60	38	15·58
12·3	8	3·20	38	15·58	20×0·5	372	66·96	38	15·58
12·4	8	3·20	38	15·58	20×0·5	374	67·32	38	15·58
12·5	8	3·20	38	15·58	20×0·5	377	67·86	38	15·58
12·6	8	3·20	39	15·99	20×0·5	379	68·22	39	15·99
12·7	8	3·20	39	15·99	20×0·5	381	68·58	39	15·99
12·8	8	3·20	39	15·99	20×0·5	383	68·94	39	15·99
12·9	8	3·20	39	15·99	20×0·5	385	69·30	39	15·99
13·0	8	3·20	40	16·40	20×0·5	387	69·66	40	16·40
13·1	8	3·20	40	16·40	20×0·5	390	70·20	40	16·40
13·2	8	3·20	40	16·40	20×0·5	392	70·56	40	16·40
13·3	8	3·20	41	16·81	20×0·5	394	70·92	41	16·81
13·4	9	3·60	41	16·81	20×0·5	396	71·28	41	16 81
13·5	9	3·60	42	17·22	20×0·5	398	71·64	42	17·22
13·6	9	3·60	42	17·22	20×0·5	400	72·00	42	17·22
13·7	9	3·60	43	17·63	20×0·5	402	72·36	43	17·63
13·8	9	3·60	43	17·63	20×0·5	405	72·90	43	17·63
13·9	9	3·60	44	18·04	20×0·5	407	73·26	44	18·04
14·0	9	3·60	45	18·45	20×0·8	675	121·50	45	18·45
14·1	9	3·60	45	18·45	20×0·8	678	122·10	45	18·45
14·2	9	3·60	46	18·86	20×0·8	681	122·60	46	18·86
14·3	9	3·60	47	19·27	20×0·8	685	123·30	47	19·27
14·4	9	3·60	47	19·27	20×0·8	688	123·84	47	19·27
14·5	9	3·60	48	19·68	20×0·8	692	124·56	48	19·68

(All Weights and Prices are per Kilometre.)

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
52	3·44	26	1·64	471	91·86	2·30	30	7·50	131·66	10·0
52	3·44	26	1·64	473	92·22	2·31	30	7·50	132·03	10·1
53	3·50	27	1·70	480	93·92	2·35	30	7·50	133·77	10·2
53	3·50	27	1·70	482	94·28	2·36	30	7 50	134·14	10·3
53	3·50	27	1·70	485	94·82	2·37	30	7·50	134·69	10·4
55	3·63	28	1·77	492	96·20	2·41	30	7·50	136·11	10·5
55	3·63	28	1·77	494	96·56	2·42	30	7·50	136·48	10·6
55	3·63	28	1·77	496	96·92	2·43	30	7·50	136·85	10·7
55	3·63	28	1·77	498	97·38	2·44	30	7·50	137·32	10·8
55	3·63	28	1·77	500	97·73	2·45	30	7·50	137·68	10·9
56	3·70	28	1·77	505	98·89	2·47	30	7·50	138·86	11·0
56	3·70	28	1·77	507	99·25	2·48	30	7·50	139·23	11·1
56	3·70	28	1·77	510	99·79	2·50	30	7·50	139·79	11·2
56	3·70	28	1·77	512	100·15	2·51	30	7·50	140·16	11·3
58	3·83	29	1·83	519	101·52	2·54	30	7·50	141·56	11·4
58	3·83	29	1·83	521	101·88	2·55	30	7·50	141·93	11·5
58	3·83	29	1·83	523	102·24	2·56	30	7·50	142·30	11·6
58	3·83	29	1·83	526	103·00	2·58	30	7·50	143·08	11·7
60	3·96	30	1·89	534	104·55	2·62	30	7·50	144·67	11·8
60	3·96	30	1·89	536	104·91	2·63	30	7·50	145·04	11·9
60	3·96	30	1·89	538	105·27	2·64	30	7·50	145·41	12·0
60	3·96	30	1·89	540	105·63	2·64	30	7·50	145·77	12·1
61	4·03	31	1·96	546	106·96	2·67	30	7·50	147·13	12·2
61	4·03	31	1·96	548	107·32	2·69	30	7·50	147·51	12·3
61	4·03	31	1·96	550	107·67	2·70	30	7·50	147·87	12·4
61	4·03	31	1·96	553	108·21	2·71	30	7·50	148·42	12·5
63	4·16	32	2·02	560	109·58	2·74	30	7·50	149·82	12·6
63	4·16	32	2·02	562	109·94	2·75	30	7·50	150·19	12·7
63	4·16	32	2·02	564	110·30	2 76	30	7·50	150·56	12·8
63	4·16	32	2·02	566	110·66	2·77	30	7·50	150·93	12·9
64	4·23	32	2·02	571	111·91	2·80	30	7·50	152·21	13·0
64	4·23	32	2·02	574	112·45	2·81	40	10·00	165·26	13·1
64	4·23	32	2·02	576	112·81	2·82	40	10·00	165·63	13·2
66	4·36	33	2·08	583	114·18	2·86	40	10·00	167·04	13·3
66	4·36	33	2·08	586	115·04	2·88	40	10·00	167·92	13·4
68	4·49	34	2·14	593	116·31	2·91	40	10·00	169·22	13·5
68	4·49	34	2·14	595	116·67	2·92	40	10·00	169·59	13·6
69	4·56	35	2·21	601	117·99	2·95	40	10·00	170·94	13·7
69	4·56	35	2·21	604	118·53	2·97	40	10·00	171·50	13·8
71	4·69	36	2·27	611	119·90	3·00	40	10·00	172·90	13·9
72	4·76	36	2·27	882	169·03	4·22	40	10·00	223·25	14·0
72	4·76	36	2·27	885	170·63	4·27	50	12·50	237·40	14·1
74	4·89	37	2·33	893	171·14	4·28	50	12·50	237·92	14·2
76	5·02	38	2·40	902	172·86	4·32	50	12·50	239·68	14·3
76	5·02	38	2·40	905	173·40	4·34	50	12·50	240·24	14·4
77	5·09	39	2·46	913	175·07	4·38	50	12·50	241·95	14·5

TABLE NO. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings,	Kilog. per km.	Price, shillings
14·6	9	3·60	48	19·68	20×0·8	695	125·10	48	19·68
14·7	9	3·60	48	19·68	20×0·8	699	125·82	48	19·68
14·8	9	3·60	49	20 09	20×0·8	702	126·36	49	20·09
14·9	9	3·60	50	20·50	20×0·8	705	126·90	59	20·50
15·0	9	3·60	50	20·50	20×0·8	709	127·62	50	20·50
15·1	10	4·00	51	20·91	20×0·8	712	128·16	51	20·91
15·2	10	4·00	51	20·91	20×0·8	716	128·88	51	20·91
15·3	10	4·00	52	21·32	20×0·8	719	129·42	52	21·32
15·4	10	4·00	52	21·32	20×0·8	723	130·14	52	21·32
15·5	10	4·00	53	21·73	20×0·8	726	130·68	53	21·73
15·6	10	4·00	53	21·73	20×0·8	730	131·40	53	21·73
15·7	10	4·00	54	22·14	20×0·8	733	131·94	54	22·14
15·8	10	4·00	55	22·55	20×0·8	737	132·66	55	22·55
15·9	10	4·00	55	22·55	20×0·8	740	133·20	55	22·55
16·0	10	4·00	56	22·96	20×0·8	743	133·74	56	22·96
16·1	10	4·00	56	22·96	25×0·9	846	152·28	56	22·96
16·2	10	4·00	57	23·37	25×0·9	850	153·00	57	23·37
16·3	10	4·00	57	23·37	25×0·9	853	153·24	57	23·37
16·4	10	4·00	58	23·78	25×0·9	857	154·26	58	23·78
16·5	10	4·00	58	23·78	25×0·9	861	154·98	58	23·78
16·6	10	4·00	59	24·19	25×0·9	865	155·70	59	24·19
16·7	11	4·40	59	24·19	25×0·9	869	156·42	59	24·19
16·8	11	4·40	60	24·60	25×0·9	873	157·14	60	24·60
16·9	11	4·40	61	25·01	25×0·9	877	157·86	61	25·01
17·0	11	4·40	61	25·01	25×0·9	881	158·58	61	25·01
17·1	11	4·40	62	25·42	25×0·9	884	159·12	62	25·42
17·2	11	4·40	62	25·42	25×0·9	888	159·84	62	25·42
17·3	11	4·40	63	25·83	25×0·9	892	160·56	63	25·83
17·4	11	4·40	63	25·83	25×0·9	896	161·28	63	25·83
17·5	11	4·40	64	26·24	25×0·9	900	162·00	64	26·24
17·6	11	4·40	64	26·24	25×0·9	904	162·72	64	26·24
17·7	11	4·40	65	26·65	25×0·9	908	163·44	65	26·65
17·8	11	4·40	65	26·65	25×0·9	912	164·16	65	26·65
17·9	11	4·40	66	27·06	25×0·9	916	164·88	66	27·06
18·0	11	4·40	67	27·47	25×0·9	919	165·42	67	27·47
18·1	11	4·40	67	27·47	25×0·9	923	166·14	67	27·47
18·2	11	4·40	68	27·88	25×0·9	927	166·86	68	27·88
18·3	11	4·40	68	27·88	25×0·9	931	167·58	68	27·88
18·4	12	4·80	69	28·29	25×0·9	935	168·30	69	28·29
18·5	12	4·80	69	28·29	25×0·9	939	169·02	69	28·29
18·6	12	4·80	70	28·70	25×0·9	943	169·74	70	28·70
18·7	12	4·80	70	28·70	25×0·9	946	170·28	70	28·70
18·8	12	4·80	71	29·11	25×0·9	950	171·00	71	29·11
18·9	12	4·80	71	29·11	25×0·9	954	171·72	71	29·11
19·0	12	4·80	72	29·52	25×0·9	958	172·44	72	29·52
19·1	12	4·80	72	29·52	25×0·9	962	173·16	72	29·52

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
77	5·09	39	2·46	916	175·61	4·39	50	12·50	242·50	14·6
77	5·09	39	2·46	920	176·33	4·41	50	12·50	243·24	14·7
79	5·22	40	2·52	928	177·88	4·45	50	12·50	244·83	14·8
79	5·22	40	2·52	934	179·30	4·49	50	12·50	246·29	14·9
80	5·28	40	2·52	938	180·02	4·50	50	12·50	247·12	15·0
82	5·42	41	2·59	947	181·99	4·55	50	12·50	249·04	15·1
82	5·42	41	2·59	951	183·71	4·60	50	12·50	250·81	15·2
84	5·55	42	2·65	959	184·26	4·61	50	12·50	251·37	15·3
84	5·55	42	2·65	963	184·98	4·63	50	12·50	252·11	15·4
85	5·61	43	2·71	970	186·46	4·66	50	12·50	253·62	15·5
85	5·61	43	2·71	974	187·18	4·68	50	12·50	254·36	15·6
87	5·75	44	2·78	982	188·75	4·72	50	12·50	255·97	15·7
88	5·81	44	2·78	989	190·36	4·76	50	12·50	257·62	15·8
88	5·81	44	2·78	992	190·89	4·78	50	12·50	258·17	15·9
90	5·94	45	2·84	1000	192·44	4·82	50	12·50	259·76	16·0
90	5·94	45	2·84	1103	210·98	5·28	60	15	291·26	16·1
92	6·08	46	2·90	1112	212·72	5·32	60	15	293·04	16·2
92	6·08	46	2·90	1115	213·26	5·34	60	15	293·60	16·3
93	6·14	47	2·96	1123	214·93	5·38	60	15	295·31	16·4
93	6·14	47	2·96	1127	215·44	5·39	60	15	295·83	16·5
95	6·27	48	3·03	1136	217·38	5·44	60	15	297·82	16·6
95	6·27	48	3·03	1141	218·50	5·47	60	15	298·97	16·7
96	6·34	48	3·03	1148	220·11	5·50	60	15	300·61	16·8
98	6·47	49	3·09	1157	221·84	5·55	60	15	302·39	16·9
98	6·47	49	3·09	1161	222·56	5·57	60	15	303·13	17·0
100	6·60	50	3·15	1169	224·11	5·61	60	30	319·72	17·1
100	6·60	50	3·15	1173	224·83	5·62	60	30	320·45	17·2
101	6·67	51	3·22	1181	226·51	5·67	60	30	322·18	17·3
101	6·67	51	3·22	1185	227·23	5·68	60	30	322·21	17·4
103	6·80	52	3·28	1194	228·96	5·72	60	30	324·68	17·5
103	6·80	52	3·28	1198	229·78	5·75	60	30	325·53	17·6
104	6·87	52	3·28	1205	231·29	5·78	60	30	327·07	17·7
104	6·87	52	3·28	1209	232·01	5·80	60	30	327·81	17·8
106	7·00	53	3·34	1218	233·74	5·85	60	30	329·59	17·9
108	7·13	54	3·41	1226	235·30	5·89	60	30	331·19	18·0
108	7·13	54	3·41	1230	236·02	5·90	60	30	331·92	18·1
109	7·20	55	3·47	1238	237·69	5·94	60	30	333·63	18·2
109	7·20	55	3·47	1242	238·41	5·96	60	30	334·37	18·3
111	7·33	56	3·53	1252	240·54	6·02	60	30	336·56	18·4
111	7·33	56	3·53	1256	241·26	6·04	60	30	337·30	18·5
112	7·39	56	3·53	1263	242·90	6·08	60	30	338·98	18·6
112	7·39	56	3·53	1266	243·40	6·09	60	30	339·49	18·7
114	7·53	57	3·59	1275	245·14	6·13	60	30	341·27	18·8
114	7·53	57	3·59	1279	245·86	6·15	60	30	342·01	18·9
116	7·66	58	3·66	1288	247·60	6·19	60	30	343·79	19·0
116	7·66	58	3·66	1292	248·32	6·21	62	31	347·50	19·1

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
19·2	12	4·80	73	29·93	25×0·9	966	173·88	73	29·93
19·3	12	4·80	73	29·93	25×0·9	970	174·60	73	29·93
19·4	12	4·80	74	30·34	25×0·9	973	175·14	74	30·34
19·5	12	4·80	74	30·34	25×0·9	977	175·86	74	30·34
19·6	12	4·80	75	30·75	25×0·9	981	176·58	75	30·75
19·7	12	4·80	76	31·16	25×0·9	985	177·30	76	31·16
19·8	12	4·80	77	31·57	25×0·9	989	178·02	77	31·57
19·9	12	4·80	77	31·57	25×0·9	993	178·74	77	31·57
20·0	12	4·80	78	31·98	25×0·9	997	179·46	78	31·98
20·1	13	5·20	78	31·98	25×0·9	1001	180·18	78	31·98
20·2	13	5·20	79	32·39	25×0·9	1004	180·72	79	32·39
20·3	13	5·20	79	32·39	25×0·9	1008	181·44	79	32·39
20·4	13	5·20	80	32·80	25×0·9	1012	182·16	80	32·80
20·5	13	5·20	81	33·21	25×0·9	1016	182·88	81	33·21
20·6	13	5·20	81	33·21	25×0·9	1020	183·60	81	33·21
20·7	13	5·20	82	33·62	25×0·9	1024	184·32	82	33·62
20·8	13	5·20	82	33·62	25×0·9	1027	184·86	82	33·62
20·9	13	5·20	83	34·03	25×0·9	1031	185·58	83	34·03
21·0	13	5·20	83	34·03	25×0·9	1035	186·30	83	34·03
21·1	13	5·20	84	34·44	25×0·9	1039	187·02	84	34·44
21·2	13	5·20	84	34·44	25×0·9	1043	187·74	84	34·44
21·3	13	5·20	85	34·85	25×0·9	1047	188·46	85	34·85
21·4	13	5·20	85	34·85	25×0·9	1051	189·18	85	34·85
21·5	13	5·20	86	35·26	25×0·9	1055	189·90	86	35·26
21·6	13	5·20	86	35·26	25×0·9	1058	190·44	86	35·26
21·7	14	5·60	87	35·67	25×0·9	1062	191·16	87	35·67
21·8	14	5·60	88	36·08	25×0·9	1066	191·88	88	36·08
21·9	14	5·60	88	36·08	25×0·9	1070	192·60	88	36·08
22·0	14	5·60	89	36·49	25×0·9	1074	193·32	89	36·49
22·1	14	5·60	89	36·49	25×0·9	1079	194·22	89	36·49
22·2	14	5·60	90	36·90	25×0·9	1082	194·76	90	36·90
22·3	14	5·60	90	36·90	25×0·9	1086	195·48	90	36·90
22·4	14	5·60	91	37·31	25×0·9	1089	196·02	91	37·31
22·5	14	5·60	91	37·31	25×0·9	1093	196·74	91	37·31
22·6	14	5·60	92	37·72	25×0·9	1097	197·46	92	37·72
22·7	14	5·60	93	38·13	25×0·9	1101	198·18	93	38·13
22·8	14	5·60	93	38·13	25×0·9	1105	198·90	93	38·13
22·9	14	5·60	94	38·54	25×0·9	1109	199·62	94	38·54
23·0	14	5·60	94	38·54	25×0·9	1113	200·34	94	38·54
23·1	14	5·60	95	38·95	33×0·9	1116	200·88	95	38·95
23·2	14	5·60	95	38·95	33×0·9	1120	201·60	95	38·95
23·3	14	5·60	96	39·36	33×0·9	1124	202·32	96	39·36
23·4	15	6·00	97	39·77	33×0·9	1128	203·04	97	39·77
23·5	15	6·00	97	39·77	33×0·9	1131	203·58	97	39·77
23·6	15	6·00	98	40·18	33×0·9	1135	204·30	98	40·18
23·7	15	6·00	98	40·18	33×0·9	1140	205·20	98	40·18

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
117	7·73	59	3·72	1300	249·99	6·25	62	31	349·24	19·2
117	7·73	59	3·72	1304	250·71	6·27	62	31	349·98	19·3
119	7·86	60	3·78	1311	252·20	6·31	62	31	351·53	19·4
119	7·86	60	3·78	1315	252·92	6·33	62	31	352·25	19·5
120	7·92	60	3·78	1323	254·58	6·37	62	31	353·95	19·6
122	8·05	61	3·85	1332	256·32	6·41	62	31	355·73	19·7
124	8·19	62	3·91	1341	258·06	6·45	62	31	357·51	19·8
124	8·19	62	3·91	1345	258·78	6·47	62	31	358·25	19·9
125	8·25	63	3·97	1353	260·44	6·51	62	31	359·95	20·0
125	8·25	63	3·97	1358	261·56	6·54	64	32	364·10	20·1
127	8·38	64	4·04	1366	263·12	6·58	64	32	365·70	20·2
127	8·38	64	4·04	1370	263·84	6·60	64	32	366·44	20·3
128	8·45	64	4·04	1377	265·45	6·64	64	32	368·09	20·4
130	8·58	65	4·10	1386	267·18	6·68	64	32	369·86	20·5
130	8·58	65	4·10	1390	267·90	6·70	64	32	370·60	20·6
132	8·71	66	4·16	1399	269·63	6·74	64	32	372·37	20·7
132	8·71	66	4·16	1402	271·17	6·78	64	32	373·95	20·8
133	8·78	67	4·23	1410	271·85	6·80	64	32	374·65	20·9
133	8·78	67	4·23	1414	272·57	6·82	64	32	375·39	21·0
135	8·91	68	4·29	1423	274·30	6·86	64	32	377·16	21·1
135	8·91	68	4·29	1427	275·02	6·88	64	32	377·90	21·2
136	8·98	68	4·29	1434	276·63	6·92	64	32	379·55	21·3
136	8·98	68	4·29	1438	277·36	6·94	64	32	380·30	21·4
138	9·11	69	4·35	1447	279·08	6·98	64	32	382·06	21·5
138	9·11	69	4·35	1450	279·62	7·00	64	32	382·62	21·6
140	9·24	70	4·41	1460	281·75	7·05	64	32	384·80	21·7
141	9·31	71	4·48	1468	283·43	7·09	64	32	386·52	21·8
141	9·31	71	4·48	1472	284·15	7·11	64	32	387·26	21·9
143	9·44	72	4·54	1481	285·88	7·13	64	32	389·01	22·0
143	9·44	72	4·54	1486	286·78	7·17	66	33	392·95	22·1
144	9·51	72	4·54	1492	288·21	7·21	66	33	394·42	22·2
144	9·51	72	4·54	1496	288·93	7·22	66	33	395·15	22·3
146	9·64	73	4·60	1504	290·48	7·26	66	33	396·74	22·4
146	9·64	73	4·60	1508	291·20	7·28	66	33	397·48	22·5
148	9·77	74	4·67	1517	292·94	7·33	66	33	399·27	22·6
149	9·84	75	4·73	1525	294·61	7·37	66	33	400·98	22·7
149	9·84	75	4·73	1529	295·33	7·38	66	33	401·71	22·8
151	9·97	76	4·79	1538	297·06	7·43	66	33	403·49	22·9
151	9·97	76	4·79	1542	297·78	7·45	66	33	404·23	23·0
152	10·03	76	4·79	1548	299·20	7·48	66	33	405·68	23·1
152	10·03	76	4·79	1552	299·72	7·50	66	33	406·42	23·2
154	10·17	77	4·86	1561	301·67	7·54	66	33	408·21	23·3
156	10·30	78	4·92	1571	303·80	7·60	66	33	410·40	23·4
156	10·30	78	4·92	1574	304·34	7·61	66	33	410·95	23·5
157	10·37	79	4·98	1582	305·91	7·65	66	33	412·56	23·6
157	10·37	79	4·98	1587	306·91	7·67	66	33	413·58	23·7

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TABLE NO. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
23·8	15	6·00	99	40·59	33×0·9	1143	205·74	99	40·59
23·9	15	6·00	99	40·59	33×0·9	1147	206·46	99	40·59
24·0	15	6·00	100	41·00	33×0·9	1151	207·18	100	41·00
24·1	15	6·00	101	41·41	33×0·9	1155	207·90	101	41·41
24·2	15	6·00	101	41·41	33×0·9	1159	208·62	101	41·41
24·3	15	6·00	102	41·82	33×0·9	1163	209·34	102	41·82
24·4	15	6·00	102	41·82	33×0·9	1167	210·06	102	41·82
24·5	15	6·00	103	42·23	33×0·9	1170	210·60	103	42·23
24·6	15	6·00	103	42·23	33×0·9	1174	211·32	103	42·23
24·7	15	6·00	104	42·64	33×0·9	1178	212·04	104	42·64
24·8	15	6·00	104	42·64	33×0·9	1182	212·76	104	42·64
24·9	15	6·00	105	43·05	33×0·9	1186	213·48	105	43·05
25·0	15	6·00	105	43·05	33×0·9	1190	214·20	105	43·05
25·1	16	6·40	106	43·46	33×0·9	1193	214·74	106	43·46
25·2	16	6·40	107	43·87	33×0·9	1197	215·46	107	43·87
25·3	16	6·40	107	43·87	33×0·9	1201	216·18	107	43·87
25·4	16	6·40	108	44·28	33×0·9	1205	216·90	108	44·28
25·5	16	6·40	108	44·28	33×0·9	1209	217·62	108	44·28
25·6	16	6·40	109	44·69	33×0·9	1213	218·34	109	44·69
25·7	16	6·40	109	44·69	33×0·9	1217	219·06	109	44·69
25·8	16	6·40	110	45·10	33×0·9	1221	219·78	110	45·10
25·9	16	6·40	110	45·10	33×0·9	1224	220·32	110	45·10
26·0	16	6·40	111	45·51	33×0·9	1228	221·04	111	45·51
26·1	16	6·40	112	45·92	33×0·9	1232	221·76	112	45·92
26·2	16	6·40	112	45·92	33×0·9	1236	222·48	112	45·92
26·3	16	6·40	113	46·33	33×0·9	1240	223·20	113	46·33
26·4	16	6·40	113	46·33	33×0·9	1244	223·92	113	46·33
26·5	16	6·40	114	46·74	33×0·9	1248	224·64	114	46·74
26·6	16	6·40	114	46·74	33×0·9	1251	225·18	114	46·74
26·7	17	6·80	115	47·15	33×0·9	1256	226·08	115	47·15
26·8	17	6·80	116	47·56	33×0·9	1259	226·62	116	47·56
26·9	17	6·80	116	47·56	33×0·9	1263	227·34	116	47·56
27·0	17	6·80	117	47·97	33×0·9	1267	228·06	117	47·97
27·1	17	6·80	117	47·97	33×0·9	1271	228·78	117	47·97
27·2	17	6·80	118	48·38	33×0·9	1275	229·50	118	48·38
27·3	17	6·80	118	48·38	33×0·9	1279	230·22	118	48·38
27·4	17	6·80	119	48·79	33×0·9	1282	230·76	119	48·79
27·5	17	6·80	120	49·20	33×0·9	1286	231·48	120	49·20
27·6	17	6·80	120	49·20	33×0·9	1290	232·20	120	49·20
27·7	17	6·80	121	49·61	33×0·9	1294	232·92	121	49·61
27·8	17	6·80	121	49·61	33×0·9	1298	233·64	121	49·61
27·9	17	6·80	122	50·02	33×0·9	1302	234·36	122	50·02
28·0	17	6·80	122	50·02	33×0·9	1306	235·08	122	50·02
28·1	17	6·80	123	50·43	33×0·9	1310	235·80	123	50·43
28·2	17	6·80	124	50·84	33×0·9	1313	236·34	124	50·84
28·3	17	6·80	124	50·84	33×0·9	1317	237·06	124	50·84

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
159	10·50	80	5·04	1595	308·46	7·71	66	33	415·17	23·8
159	10·50	80	5·04	1599	309·18	7·73	66	33	415·91	23·9
160	10·57	80	5·04	1606	310·79	7·77	66	33	417·56	24·0
162	10·70	81	5·11	1615	312·53	7·81	70	43·75	434·09	24·1
162	10·70	81	5·11	1619	313·25	7·83	70	43·75	434·83	24·2
164	10·83	82	5·17	1628	314·98	7·88	70	43·75	436·61	24·3
164	10·83	82	5·17	1632	315·70	7·90	70	43·75	437·35	24·4
165	10·89	83	5·23	1639	317·18	7·93	70	43·75	438·86	24·5
165	10·89	83	5·23	1643	317·90	7·95	70	43·75	439·60	24·6
167	11·03	84	5·30	1652	319·65	8·00	70	43·75	441·40	24·7
167	11·03	84	5·30	1656	320·37	8·01	70	43·75	442·13	24·8
168	11·10	84	5·30	1663	321·98	8·05	70	43·75	443·78	24·9
168	11·10	84	5·30	1667	322·70	8·07	70	43·75	444·52	25·0
170	11·22	85	5·36	1676	324·64	8·12	70	43·75	446·51	25·1
172	11·36	86	5·42	1685	326·38	8·16	70	43·75	448·29	25·2
172	11·36	86	5·42	1689	327·10	8·18	70	43·75	449·03	25·3
173	11·42	87	5·49	1697	328·78	8·22	70	43·75	450·75	25·4
173	11·42	87	5·49	1701	329·49	8·24	70	43·75	451·48	25·5
175	11·55	88	5·55	1710	331·22	8·28	70	43·75	453·25	25·6
175	11·55	88	5·55	1714	331·94	8·30	70	43·75	453·99	25·7
176	11·63	88	5·55	1721	333·56	8·34	70	43·75	455·65	25·8
176	11·63	88	5·55	1724	334·10	8·36	70	43·75	456·21	25·9
178	11·75	89	5·61	1733	335·82	8·40	70	43·75	457·97	26·0
180	11·88	90	5·67	1742	337·55	8·44	72	45	462·99	26·1
180	11·88	90	5·67	1746	338·27	8·46	72	45	463·73	26·2
181	11·95	91	5·74	1754	339·95	8·50	72	45	465·45	26·3
181	11·95	91	5·74	1758	340·67	8·52	72	45	466·19	26·4
183	12·08	92	5·80	1767	342·50	8·57	72	45	468·07	26·5
183	12·08	92	5·80	1770	342·94	8·58	72	45	468·52	26·6
184	12·15	92	5·80	1779	345·13	8·63	72	45	470·76	26·7
186	12·28	93	5·86	1787	346·68	8·67	72	45	472·35	26·8
186	12·28	93	5·86	1791	347·40	8·69	72	45	473·09	26·9
188	12·41	94	5·93	1800	349·14	8·73	72	45	474·87	27·0
188	12·41	94	5·93	1804	350·86	8·77	75	46·87	481·50	27·1
189	12·48	95	5·99	1812	351·54	8·79	75	46·87	482·20	27·2
189	12·48	95	5·99	1816	352·25	8·81	75	46·87	482·93	27·3
191	12·61	96	6·05	1824	353·80	8·85	75	46·87	484·52	27·4
192	12·68	96	6·05	1831	355·86	8·90	75	46·87	486·63	27·5
192	12·68	96	6·05	1835	356·13	8·91	75	46·87	486·91	27·6
194	12·81	97	6·12	1844	357·84	8·95	75	46·87	488·66	27·7
194	12·81	97	6·12	1848	358·59	8·97	75	46·87	489·43	27·8
196	12·94	98	6·18	1857	360·32	9·01	75	46·87	491·20	27·9
196	12·94	98	6·18	1861	361·04	9·03	75	46·87	491·94	28·0
197	13·00	99	6·24	1869	362·70	9·07	75	46·87	493·64	28·1
199	13·14	100	6·30	1877	364·26	9·11	75	46·87	495·24	28·2
199	13·14	100	6·30	1881	364·98	9·13	75	46·87	495·98	28·3

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
28·4	18	7·20	125	51·25	33×0·9	1321	237·78	125	51·25
28·5	18	7·20	125	51·25	33×0·9	1325	238·50	125	51·25
28·6	18	7·20	126	51·66	33×0·9	1329	239·22	126	51·66
28·7	18	7·20	126	51·66	33×0·9	1333	239·94	126	51·66
28·8	18	7·20	127	52·07	33×0·9	1337	240·66	127	52·07
28·9	18	7·20	127	52·07	33×0·9	1340	241·20	127	52·07
29·0	18	7·20	128	52·48	33×0·9	1344	241·92	128	52·48
29·1	18	7·20	128	52·48	33×0·9	1347	242·46	128	52·48
29·2	18	7·20	129	52·89	33×0·9	1352	243·56	129	52·89
29·3	18	7·20	129	52·89	33×0·9	1356	244·08	129	52·89
29·4	18	7·20	130	53·30	33×0·9	1360	244·80	130	53·30
29·5	18	7·20	130	53·30	33×0·9	1364	245·52	130	53·30
29·6	18	7·20	131	53·71	33×0·9	1367	246·06	131	53·71
29·7	18	7·20	132	54·12	33×0·9	1371	246·78	132	54·12
29·8	18	7·20	132	54·12	33×0·9	1375	247·50	132	54·12
29·9	18	7·20	133	54·53	33×0·9	1379	248·22	133	54·53
30·0	18	7·20	133	54·53	33×0·9	1383	248·94	133	54·53
30·1	19	7·60	134	54·94	33×0·9	1387	249·66	134	54·94
30·2	19	7·60	134	54·94	33×0·9	1391	250·38	134	54·94
30·3	19	7·60	135	55·35	33×0·9	1395	251·10	135	55·35
30·4	19	7·60	136	55·76	33×0·9	1398	251·64	136	55·76
30·5	19	7·60	137	56·17	33×0·9	1402	252·36	137	56·17
30·6	19	7·60	137	56·17	33×0·9	1406	253·08	137	56·17
30·7	19	7·60	138	56·58	33×0·9	1410	253·80	138	56·58
30·8	19	7·60	138	56·58	33×0·9	1414	254·52	138	56·58
30·9	19	7·60	139	56·99	33×0·9	1418	255·24	139	56·99
31·0	19	7·60	139	56·99	33×0·9	1421	255·78	139	56·99
31·1	19	7·60	140	57·40	33×0·9	1425	256·50	140	57·40
31·2	19	7·60	140	57·40	33×0·9	1429	257·22	140	57·40
31·3	19	7·60	141	57·81	33×0·9	1433	257·94	141	57·81
31·4	19	7·60	141	57·81	33×0·9	1437	258·66	141	57·81
31·5	19	7·60	142	58·22	33×0·9	1441	259·38	142	58·22
31·6	19	7·60	142	58·22	33×0·9	1445	260·08	142	58·22
31·7	20	8	143	58·63	33×0·9	1449	260·80	143	58·63
31·8	20	8	143	58·63	33×0·9	1452	261·34	143	58·63
31·9	20	8	144	59·04	33×0·9	1456	262·06	144	59·04
32·0	20	8	144	59·04	33×0·9	1460	262·78	144	59·04
32·1	20	8	145	59·45	43×1	1637	294·66	145	59·45
32·2	20	8	145	59·45	43×1	1641	295·38	145	59·45
32·3	20	8	146	59·86	43×1	1645	296·10	146	59·86
32·4	20	8	147	60·27	43×1	1650	297·00	147	60·27
32·5	20	8	147	60·27	43×1	1654	297·72	147	60·27
32·6	20	8	148	60·68	43×1	1658	298·44	148	60·68
32·7	20	8	148	60·68	43×1	1663	299·34	148	60·68
32·8	20	8	149	61·09	43×1	1667	300·06	149	61·09
32·9	20	8	149	61·09	43×1	1671	300·78	149	61·09

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
200	13·20	100	6·30	1889	366·98	9·18	75	46·87	498·03	28·4
200	13·20	100	6·30	1893	367·70	9·20	75	46·87	498·77	28·5
202	13·34	101	6·37	1902	369·45	9·24	75	46·87	500·56	28·6
202	13·34	101	6·37	1906	370·17	9·26	75	46·87	501·30	28·7
204	13·47	102	6·43	1915	371·91	9·30	75	46·87	503·08	28·8
204	13·47	102	6·43	1918	372·44	9·31	75	46·87	503·62	28·9
205	13·53	103	6·49	1926	374·10	9·35	75	46·87	505·32	29·0
205	13·53	103	6·49	1929	374·64	9·37	80	50·00	514·01	29·1
207	13·67	104	6·56	1939	376·57	9·42	80	50·00	515·99	29·2
207	13·67	104	6·56	1943	377·29	9·44	80	50·00	516·73	29·3
208	13·73	104	6·56	1950	378·89	9·47	80	50·00	518·36	29·4
208	13·73	104	6·56	1954	380·61	9·52	80	50·00	520·13	29·5
210	13·87	105	6·62	1962	381·17	9·53	80	50·00	520·70	29·6
212	14·00	106	6·68	1971	382·90	9·57	80	50 00	522·48	29·7
212	14·00	106	6·68	1975	383·62	9·59	80	50·00	523·27	29·8
213	14·07	107	6·74	1983	385·29	9·63	80	50·00	524·91	29·9
213	14·07	107	6·74	1987	386·01	9·65	80	50·00	525·62	30·0
215	14·20	108	6·81	1997	388·15	9·70	82	51·25	531·16	30·1
215	14·20	108	6·81	2001	388·87	9·72	82	51·25	531·84	30·2
216	14·26	108	6·81	2008	390·47	9·76	82	51·25	533·48	30·3
218	14·39	109	6·87	2016	392·02	9·80	82	51·25	535·07	30·4
220	14·52	110	6·93	2025	393·75	9·85	82	51·25	536·85	30·5
220	14·52	110	6·93	2029	394·47	9·87	82	51·25	537·59	30·6
221	14·59	111	7·00	2037	396·15	9·91	82	51·25	539·31	30·7
221	14·59	111	7·00	2041	396·87	9·93	82	51·25	540·05	30·8
223	14·72	112	7·06	2050	398·60	9·97	82	51·25	541·82	30·9
223	14·72	112	7·06	2053	399·14	9·98	82	51·25	542·37	31·0
224	14·79	112	7·06	2060	400·75	10·02	82	51·25	544·02	31·1
224	14·79	112	7·06	2064	401·47	10·04	82	51·25	544·76	31·2
226	14·92	113	7·12	2073	403·20	10·08	82	51·25	546·53	31·3
226	14·92	113	7·12	2077	403·92	10·10	82	51·25	547·27	31·4
228	15·05	114	7·18	2086	405·65	10·14	82	51·25	549·04	31·5
228	15·05	114	7·18	2090	406·35	10·16	82	51·25	549·76	31·6
229	15·12	115	7·25	2099	408·43	10·21	82	51·25	551·89	31·7
229	15·12	115	7·25	2102	408·97	10·22	82	51·25	552·44	31·8
231	15·25	116	7·31	2111	410·70	10·27	82	51·25	554·22	31·9
231	15·25	116	7·31	2115	411·42	10·29	82	51·25	554·96	32·0
232	15·32	116	7·31	2295	444·19	11·11	85	53·13	593·43	32·1
232	15·32	116	7·31	2299	444·91	11·13	85	53·13	594·17	32·2
234	15·45	117	7·37	2308	446·64	11·17	85	53·13	594·94	32·3
236	15·58	118	7·44	2318	448·56	11·22	85	53·13	597·91	32·4
236	15·58	118	7·44	2322	449·28	11·23	85	53·13	598·64	32·5
237	15·65	119	7·50	2330	450·95	11·28	85	53·13	600·36	32·6
237	15·65	119	7·50	2335	451·85	11·30	85	53·13	601·28	32·7
239	15·78	120	7·56	2344	453·58	11·34	85	53·13	603·05	32·8
239	15·78	120	7·56	2348	454·30	11·36	85	53·13	603·79	32·9

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
33·0	20	8·00	150	61·50	43×1	1676	301·68	150	61·50
33·1	20	8·00	151	61·91	43×1	1680	302·40	151	61·91
33·2	20	8·00	151	61·91	43×1	1684	303·12	151	61·91
33·3	20	8·00	152	62·32	43×1	1688	303·84	152	62·32
33·4	21	8·40	152	62·32	43×1	1693	304·74	152	62·32
33·5	21	8·40	153	62·73	43×1	1697	305·46	153	62·73
33·6	21	8·40	153	62·73	43×1	1701	306·18	153	62·73
33·7	21	8·40	154	63·14	43×1	1706	307·08	154	63·14
33·8	21	8·40	155	63·55	43×1	1710	307·80	155	63·55
33·9	21	8·40	155	63·55	43×1	1714	308·52	155	63·55
34·0	21	8·40	156	63·96	43×1	1718	309·24	156	63·96
34·1	21	8·40	156	63·96	43×1	1723	310·14	156	63·96
34·2	21	8·40	157	64·37	43×1	1727	310·86	157	64·37
34·3	21	8·40	157	64·37	43×1	1731	311·58	157	64·37
34·4	21	8·40	158	64·78	43×1	1736	312·48	158	64·78
34·5	21	8·40	158	64·78	43×1	1740	313·20	158	64·78
34·6	21	8·40	159	65·19	43×1	1744	313·92	159	65·19
34·7	21	8·40	159	65·19	43×1	1749	314·82	159	65·19
34·8	21	8·40	160	65·60	43×1	1753	315·54	160	65·60
34·9	21	8·40	161	66·01	43×1	1757	316·26	161	66·01
35·0	21	8·40	161	66·01	43×1	1761	316·98	161	66·01
35·1	22	8·80	162	66·42	43×1	1766	317·88	162	66·42
35·2	22	8·80	162	66·42	43×1	1770	318·60	162	66·42
35·3	22	8·80	163	66·83	43×1	1774	319·32	163	66·83
35·4	22	8·80	163	66·83	43×1	1779	320·22	163	66·83
35·5	22	8·80	164	67·24	43×1	1783	320·94	164	67·24
35·6	22	8·80	164	67·24	43×1	1787	321·66	164	67·24
35·7	22	8·80	165	67·65	43×1	1791	322·38	165	67·65
35·8	22	8·80	165	67·65	43×1	1796	323·28	165	67·65
35·9	22	8·80	166	68·06	43×1	1800	324·00	166	68·06
36·0	22	8·80	166	68·06	43×1	1804	324·72	166	68·06
36·1	22	8·80	167	68·47	43×1	1809	325·62	167	68·47
36·2	22	8·80	167	68·47	43×1	1813	326·34	167	68·47
36·3	22	8·80	168	68·88	43×1	1817	327·06	168	68·88
36·4	22	8·80	168	68·88	43×1	1821	327·78	168	68·88
36·5	22	8·80	169	69·29	43×1	1826	328·68	169	69·29
36·6	22	8·80	169	69·29	43×1	1830	329·40	169	69·29
36·7	23	9·20	170	69·70	43×1	1835	330·30	170	69·70
36·8	23	9·20	170	69·70	43×1	1839	331·02	170	69·70
36·9	23	9·20	171	70·14	43×1	1843	331·74	171	70·14
37·0	23	9·20	172	70·52	43×1	1848	332·64	172	70·52
37·1	23	9·20	173	70·93	43×1	1852	333·36	173	70·93
37·2	23	9·20	173	70·93	43×1	1856	334·08	173	70·93
37·3	23	9·20	174	71·34	43×1	1860	334·80	174	71·34
37·4	23	9·20	174	71·34	43×1	1865	335·70	174	71·34
37·5	23	9·20	175	71·75	43×1	1869	336·42	175	71·75

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent. shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
240	15·85	120	7·56	2356	456·09	11·40	85	53·13	605·62	33·0
242	15·98	121	7·63	2365	457·83	11·45	90	56·25	615·53	33·1
242	15·98	121	7·63	2369	458·55	11·47	90	56·25	616·27	33·2
244	16·11	122	7·69	2378	460·28	11·51	90	56·25	618·04	33·3
244	16·11	122	7·69	2384	462·58	11·57	90	56·25	620·40	33·4
245	16·17	123	7·75	2392	463·27	11·58	90	56·25	621·10	33·5
245	16·17	123	7·75	2396	463·96	11·60	90	56·25	621·81	33·6
247	16·31	124	7·82	2406	465·89	11·65	90	56·25	623·79	33·7
248	16·37	124	7·82	2413	467·49	11·69	90	56·25	625·43	33·8
248	16·37	124	7·82	2417	468·21	11·71	90	56·25	626·17	33·9
250	16·50	125	7·88	2426	469·94	11·75	90	56·25	627·94	34·0
250	16·50	125	7·88	2431	470·84	11·77	90	56·25	628·86	34·1
252	16·63	126	7·94	2440	472·57	11·82	90	56·25	630·64	34·2
252	16·63	126	7·94	2444	473·29	11·84	90	56·25	631·38	34·3
253	16·70	127	8·00	2453	475·14	11·88	90	56·25	633·27	34·4
253	16·70	127	8·00	2457	475·86	11·90	90	56·25	634·01	34·5
255	16·83	128	8·07	2466	477·60	11·95	90	56·25	635·80	34·6
255	16·83	128	8·07	2471	478·50	11·97	90	56·25	636·72	34·7
256	16·90	128	8·07	2478	480·11	12·00	90	56·25	638·36	34·8
258	17·03	129	8·13	2487	481·84	12·05	90	56·25	640·14	34·9
258	17·03	129	8·13	2491	482·57	12·07	90	56·25	640·89	35·0
260	17·17	130	8·19	2502	484·88	12·12	100	62·50	659·50	35·1
260	17·17	130	8·19	2506	485·60	12·14	100	62·50	660·24	35·2
261	17·23	131	8·23	2514	487·24	12·18	100	62·50	661·92	35·3
261	17·23	131	8·23	2519	488·14	12·20	100	62·50	662·84	35·4
263	17·36	132	8·32	2528	489·90	12·25	100	62·50	664·65	35·5
263	17·36	132	8·32	2532	490·62	12·27	100	62·50	665·39	35·6
264	17·43	132	8·32	2539	492·23	12·31	100	62·50	667·04	35·7
264	17·43	132	8·32	2544	493·13	12·33	100	62·50	667·96	35·8
266	17·56	133	8·38	2553	494·86	12·40	100	62·50	669·76	35·9
266	17·56	133	8·38	2557	496·58	12·42	100	62·50	671·50	36·0
268	17·69	134	8·45	2567	498·50	12·46	100	62·50	673·46	36·1
268	17·69	134	8·45	2571	499·22	12·48	100	62·50	674·20	36·2
269	17·76	135	8·51	2579	499·89	12·50	100	62·50	674·89	36·3
269	17·76	135	8·51	2583	500·61	12·52	100	62·50	675·63	36·4
271	17·89	136	8·57	2593	502·52	12·56	100	62·50	677·58	36·5
271	17·89	136	8·57	2597	503·24	12·58	100	62·50	678·32	36·6
272	17·95	136	8·57	2606	505·42	12·64	100	62·50	680·56	36·7
272	17·95	136	8·57	2610	506·14	12·65	100	62·50	681·29	36·8
274	18·09	137	8·63	2619	507·88	12·70	100	62·50	683·08	36·9
276	18·23	138	8·70	2629	509·81	12·75	100	62·50	685·06	37·0
277	18·29	139	8·76	2637	511·47	12·78	100	62·50	686·75	37·1
277	18·29	139	8·76	2641	512·19	12·81	100	62·50	687·43	37·2
279	18·42	140	8·82	2650	513·92	12·85	100	62·50	689·27	37·3
279	18·42	140	8·82	2655	514·82	12·87	100	62·50	690·19	37·4
280	18·49	140	8·82	2662	516·43	12·91	100	62·50	691·84	37·5

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
37·6	23	9·20	175	71·75	43×1	1873	337·14	175	71·75
37·7	23	9·20	176	72·16	43×1	1877	337·86	176	72·16
37·8	23	9·20	176	72·16	43×1	1881	338·58	176	72·16
37·9	23	9·20	177	72·57	43×1	1886	339·48	177	72·57
38·0	23	9·20	178	72·98	43×1	1890	340·20	178	72·98
38·1	23	9·20	178	72·98	43×1	1895	341·10	178	72·98
38·2	23	9·20	179	73·39	43×1	1899	341·82	179	73·39
38·3	23	9·20	179	73·39	43×1	1903	342·54	179	73·39
38·4	24	9·60	180	73·80	43×1	1908	343·44	180	73·80
38·5	24	9·60	180	73·80	43×1	1912	344·16	180	73·80
38·6	24	9·60	181	74·21	43×1	1916	344·88	181	74·21
38·7	24	9·60	181	74·21	43×1	1920	345·60	181	74·21
38·8	24	9·60	182	74·62	43×1	1925	346·50	182	74·62
38·9	24	9·60	182	74·62	43×1	1929	347·22	182	74·62
39·0	24	9·60	183	75·03	43×1	1933	347·94	183	75·03
39·1	24	9·60	183	75·03	43×1	1938	348·84	183	75·03
39·2	24	9·60	184	75·44	43×1	1942	349·56	184	75·44
39·3	24	9·60	185	75·85	43×1	1946	350·28	185	75·85
39·4	24	9·60	185	75·85	43×1	1950	351·00	185	75·85
39·5	24	9·60	186	76·26	43×1	1955	351·90	186	76·26
39·6	24	9·60	186	76·26	43×1	1959	352·62	186	76·26
39·7	24	9·60	187	76·67	43×1	1963	353·34	187	76·67
39·8	24	9·60	187	76·67	43×1	1967	354·06	187	76·67
39·9	24	9·60	188	77·08	43×1	1972	354·96	188	77·08
40·0	24	9·60	188	77·08	43×1	1976	355·68	188	77·08
40·1	25	10·00	189	77·49	43×1	1980	356·40	189	77·49
40·2	25	10·00	189	77·49	43×1	1985	357·30	189	77·49
40·3	25	10·00	190	77·90	43×1	1989	358·02	190	77·90
40·4	25	10·00	191	78·31	43×1	1993	358·74	191	78·31
40·5	25	10·00	191	78·31	43×1	1998	359·64	191	78·31
40·6	25	10·00	192	78·72	43×1	2002	360·36	192	78·72
40·7	25	10·00	192	78·72	43×1	2007	361·26	192	78·72
40·8	25	10·00	193	79·13	43×1	2011	361·98	193	79·13
40·9	25	10·00	193	79·13	43×1	2015	362·70	193	79·13
41·0	25	10·00	194	79·54	43×1	2019	363·42	194	79·54
41·1	25	10·00	195	79·95	43×1	2024	364·32	195	79·95
41·2	25	10·00	196	80·36	43×1	2028	365·04	196	80·36
41·3	25	10·00	197	80·77	43×1	2032	365·76	197	80·77
41·4	25	10·00	198	81·18	43×1	2036	366·48	198	81·18
41·5	25	10·00	198	81·18	43×1	2041	367·38	198	81·18
41·6	25	10·00	199	81·59	43×1	2045	368·10	199	81·59
41·7	26	10·40	199	81·59	43×1	2049	368·82	199	81·59
41·8	26	10·40	199	81·59	43×1	2054	369·72	199	81·59
41·9	26	10·40	200	82·00	43×1	2058	370·44	199	81·59
42·0	26	10·40	200	82·00	43×1	2062	371·16	200	82·00
42·1	26	10·40	200	82·00	43×1	2066	371·88	200	82·00

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent, shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
280	18·49	140	8·82	2666	517·15	12·93	100	62·50	692·58	37·6
282	18·62	141	8·89	2675	518·89	12·97	100	62·50	694·36	37·7
282	18·62	141	8·89	2679	519·61	12·99	100	62·50	695·10	37·8
284	18·75	142	8·95	2689	521·52	13·04	100	62·50	697·06	37·9
285	18·82	143	9·01	2697	523·19	13·08	100	62·50	698·77	38·0
285	18·82	143	9·01	2702	524·09	13·10	105	78·75	720·94	38·1
287	18·95	144	9·07	2711	525·82	13·15	105	78·75	722·72	38·2
287	18·95	144	9·07	2715	526·54	13·17	105	78·75	723·46	38·3
288	19·01	144	9·07	2724	528·72	13·22	105	78·75	725·69	38·4
288	19·01	144	9·07	2728	529·44	13·24	105	78·75	726·43	38·5
290	19·15	145	9·14	2737	531·19	13·28	105	78·75	728·22	38·6
290	19·15	145	9·14	2741	531·91	13·30	105	78·75	728·96	38·7
292	19·28	146	9·20	2751	533·82	13·35	105	78·75	730·92	38·8
292	19·28	146	9·20	2755	534·54	13·36	105	78·75	731·65	38·9
293	19·35	147	9·26	2763	536·21	13·41	105	78·75	733·37	39·0
293	19·35	147	9·26	2768	537·11	13·43	105	78·75	734·29	39·1
295	19·48	148	9·33	2777	538·85	13·47	105	78·75	736·07	39·2
296	19·54	148	9·33	2784	540·45	13·51	105	78·75	737·71	39·3
296	19·54	148	9·33	2788	541·17	13·53	105	78·75	738·45	39·4
298	19·67	149	9·39	2798	543·08	13·58	105	78·75	740·41	39·5
298	19·67	149	9·39	2802	543·80	13·59	105	78·75	741·14	39·6
300	19·80	150	9·45	2811	545·53	13·64	105	78·75	742·92	39·7
300	19·80	150	9·45	2815	546·25	13·66	105	78·75	743·66	39·8
301	19·87	151	9·52	2824	548·11	13·70	105	78·75	745·56	39·9
301	19·87	151	9·52	2828	548·86	13·72	105	78·75	746·33	40·0
303	20·00	152	9·58	2838	550·96	13·78	105	78·75	748·49	40·1
303	20·00	152	9·58	2843	551·86	13·80	105	78·75	749·41	40·2
304	20·07	152	9·58	2850	553·47	13·84	105	78·75	751·06	40·3
306	20·20	153	9·64	2859	555·20	13·88	105	78·75	752·83	40·4
306	20·20	153	9·64	2864	556·10	13·90	105	78·75	753·75	40·5
308	20·33	154	9·70	2873	557·83	13·94	105	78·75	755·52	40·6
308	20·33	154	9·70	2878	558·73	13·97	105	78·75	756·45	40·7
309	20·40	155	9·77	2886	560·41	14·01	105	78·75	758·17	40·8
309	20·40	155	9·77	2890	561·13	14·03	105	78·75	758·91	40·9
311	20·53	156	9·83	2899	562·86	14·07	105	78·75	760·68	41·0
312	20·60	156	9·83	2907	564·65	14·12	105	78·75	762·52	41·1
314	20·73	157	9·89	2916	566·38	14·16	105	78·75	764·29	41·2
316	20·86	158	9·96	2925	568·12	14·20	105	78·75	766·07	41·3
317	20·93	159	10·02	2933	569·79	14·24	105	78·75	767·78	41·4
317	20·93	159	10·02	2938	571·69	14·29	105	78·75	769·73	41·5
319	21·06	160	10·08	2947	572·42	14·31	105	78·75	770·48	41·6
319	21·06	160	10·08	2952	573·54	14·34	105	78·75	771·63	41·7
319	21·06	160	10·08	2957	574·44	14·36	105	78·75	772·55	41·8
320	21·13	160	10·08	2964	576·05	14·40	105	78·75	774·20	41·9
320	21·13	160	10·08	2968	576·77	14·42	105	78·75	774·90	42·0
320	21·13	160	10·08	2972	577·49	14·44	110	82·50	784·43	42·1

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
42·2	26	10·40	201	82·41	43×1	2070	372·60	201	82·41
42·3	26	10·40	201	82·41	43×1	2075	373·50	201	82·41
42·4	26	10·40	202	82·82	43×1	2079	374·22	202	82·82
42·5	26	10·40	202	82·82	43×1	2084	375·12	202	82·82
42·6	26	10·40	203	83·23	43×1	2088	375·84	203	83·23
42·7	26	10·40	203	83·23	43×1	2092	376·56	203	83·23
42·8	26	10·40	204	83·64	43×1	2097	377·46	204	83·64
42·9	26	10·40	204	83·64	43×1	2101	378·18	204	83·64
43·0	26	10·40	205	84·05	43×1	2105	378·90	205	84·05
43·1	26	10·40	205	84·05	55×1·1	2278	410·04	205	84·05
43·2	26	10·40	206	84·46	55×1·1	2282	410·76	206	84·46
43·3	26	10·40	206	84·46	55×1·1	2287	411·66	206	84·46
43·4	27	10·80	207	84·87	55×1·1	2292	412·56	207	84·87
43·5	27	10·80	208	85·28	55×1·1	2296	413·28	208	85·28
43·6	27	10·80	209	85·69	55×1·1	2301	414·18	209	85·69
43·7	27	10·80	209	85·69	55×1·1	2306	415·08	209	85·69
43·8	27	10·80	210	86·10	55×1·1	2310	415·80	210	86·10
43·9	27	10·80	210	86·10	55×1·1	2315	416·70	210	86·10
44·0	27	10·80	211	86·51	55×1·1	2319	417·42	211	86·51
44·1	27	10·80	211	86·51	55×1·1	2324	418·32	211	86·51
44·2	27	10·80	212	86·92	55×1·1	2328	419·04	212	86·92
44·3	27	10·80	213	87·33	55×1·1	2333	419·94	213	87·33
44·4	27	10·80	213	87·33	55×1·1	2338	420·84	213	87·33
44·5	27	10·80	214	87·74	55×1·1	2342	421·56	214	87·74
44·6	27	10·80	214	87·74	55×1·1	2347	422·46	214	87·74
44·7	27	10·80	215	88·15	55×1·1	2352	423·36	215	88·15
44·8	27	10·80	215	88·15	55×1·1	2356	424·08	215	88·15
44·9	27	10·80	216	88·56	55×1·1	2361	424·98	216	88·56
45·0	27	10·80	216	88·56	55×1·1	2365	425·70	216	88·56
45·1	28	11·20	217	88·97	55×1·1	2370	426·60	217	88·97
45·2	28	11·20	218	89·38	55×1·1	2375	427·50	218	89·38
45·3	28	11·20	218	89·38	55×1·1	2379	428·22	218	89·38
45·4	28	11·20	219	89·79	55×1·1	2384	429·12	219	89·79
45·5	28	11·20	219	89·79	55×1·1	2389	430·02	219	89·79
45·6	28	11·20	220	90·20	55×1·1	2393	430·74	220	90·20
45·7	28	11·20	221	90·61	55×1·1	2398	431·64	221	90·61
45·8	28	11·20	221	90·61	55×1·1	2403	432·55	221	90·61
45·9	28	11·20	222	91·02	55×1·1	2407	433·22	222	91·02
46·0	28	11·20	222	91·02	55×1·1	2412	434·12	222	91·02
46·1	28	11·20	223	91·43	55×1·1	2416	434·84	223	91·43
46·2	28	11·20	223	91·43	55×1·1	2421	435·74	223	91·43
46·3	28	11·20	224	91·84	55×1·1	2426	436·64	224	91·84
46·4	28	11·20	224	91·84	55×1·1	2430	437·40	224	91·84
46·5	28	11·20	225	92·25	55×1·1	2435	438·30	225	92·25
46·6	28	11·20	225	92·25	55×1·1	2440	439·20	225	92·25
46·7	29	11·60	226	92·67	55×1·1	2444	439·92	226	92·67

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
322	21·26	161	10·15	2981	579·23	14·48	110	82·50	786·21	42·2
322	21·26	161	10·15	2986	580·13	14·50	110	82·50	787·13	42·3
324	21·38	162	10·21	2995	581·85	14·54	110	82·50	788·89	42·4
324	21·38	162	10·21	3000	582·75	14·57	110	82·50	789·82	42·5
325	21·46	163	10·27	3008	584·43	14·61	110	82·50	791·54	42·6
325	21·46	163	10·27	3012	585·15	14·63	110	82·50	792·28	42·7
327	21·59	164	10·34	3022	587·07	14·68	110	82·50	794·25	42·8
327	21·59	164	10·34	3026	587·79	14·70	110	82·50	794·99	42·9
328	21·65	164	10·34	3033	589·39	14·74	110	82·50	796·63	43·0
328	21·65	164	10·34	3206	620·53	15·51	110	82·50	828·54	43·1
330	21·78	165	10·40	3215	622·26	15·56	110	82·50	830·32	43·2
330	21·78	165	10·40	3220	623·16	15·58	110	82·50	831·24	43·3
332	21·92	166	10·46	3231	625·48	15·64	110	82·50	833·62	43·4
333	21·98	167	10·52	3239	627·14	15·68	110	82·50	835·32	43·5
335	22·12	168	10·59	3249	629·07	15·74	110	82·50	837·31	43·6
335	22·12	168	10·59	3254	629·97	15·75	110	82·50	838·22	43·7
336	22·18	168	10·59	3261	631·57	15·79	110	82·50	839·86	43·8
336	22·18	168	10·59	3266	632·47	15·82	110	82·50	840·79	43·9
338	22·31	169	10·65	3275	634·20	15·85	110	82·50	842·55	44·0
338	22·31	169	10·65	3280	635·10	15·88	115	86·25	852·23	44·1
340	22·44	170	10·71	3289	637·19	15·93	115	86·25	854·37	44·2
341	22·51	171	10·78	3298	638·70	15·97	115	86·25	855·92	44·3
341	22·51	171	10·78	3303	639·55	15·99	115	86·25	856·83	44·4
343	22·64	172	10·84	3312	641·32	16·03	115	86·25	858·60	44·5
343	22·64	172	10·84	3317	642·22	16·05	115	86·25	859·52	44·6
344	22·71	172	10·84	3325	644·01	16·10	115	86·25	861·36	44·7
344	22·71	172	10·84	3329	644·73	16·12	115	86·25	862·10	44·8
346	22·84	173	10·90	3339	646·64	16·16	115	86·25	864·05	44·9
346	22·84	173	10·90	3343	647·46	16·18	115	86·25	864·89	45·0
348	22·97	174	10·97	3354	649·68	16·24	115	86·25	867·17	45·1
349	23·04	175	11·03	3363	651·80	16·29	115	86·25	869·34	45·2
349	23·04	175	11·03	3367	652·25	16·31	115	86·25	869·81	45·3
351	23·17	176	11·09	3377	654·16	16·35	115	86·25	871·76	45·4
351	23·17	176	11·09	3382	655·06	16·37	115	86·25	872·68	45·5
352	23·24	176	11·09	3389	656·67	16·41	115	86·25	874·33	45·6
354	23·37	177	11·15	3399	658·58	16·46	115	86·25	876·29	45·7
354	23·37	177	11·15	3404	659·49	16·49	115	86·25	877·23	45·8
356	23·50	178	11·22	3413	661·18	16·53	115	86·25	878·96	45·9
356	23·50	178	11·22	3418	662·26	16·56	115	86·25	880·07	46·0
357	23·56	179	11·28	3426	663·74	16·59	120	90·00	890·33	46·1
357	23·56	179	11·28	3431	664·64	16·61	120	90·00	891·25	46·2
359	23·70	180	11·34	3441	666·56	16·66	120	90·00	893·22	46·3
359	23·70	180	11·34	3445	667·32	16·68	120	90·00	894·00	46·4
360	23·76	180	11·34	3453	669·10	16·72	120	90·00	895·82	46·5
360	23·76	180	11·34	3458	670·00	16·75	120	90·00	896·75	46·6
362	23·90	181	11·40	3468	672·14	16·80	120	90·00	898·94	46·7

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
46·8	29	11·60	227	93·07	55×1·1	2449	440·82	227	93·07
46·9	29	11·60	227	93·07	55×1·1	2453	441·54	227	93·07
47·0	29	11·60	228	93·48	55×1·1	2458	442·44	228	93·48
47·1	29	11·60	228	93·48	55×1·1	2463	443·34	228	93·48
47·2	29	11·60	229	93·89	55×1·1	2467	444·06	229	93·89
47·3	29	11·60	229	93·89	55×1·1	2472	444·96	229	93·89
47·4	29	11·60	230	94·30	55×1·1	2477	445·86	230	94·30
47·5	29	11·60	230	94·30	55×1·1	2481	446·58	230	94·30
47·6	29	11·60	231	94·71	55×1·1	2486	447·48	231	94·71
47·7	29	11·60	231	94·71	55×1·1	2490	448·20	231	94·71
47·8	29	11·60	232	95·12	55×1·1	2495	449·10	232	95·12
47·9	29	11·60	232	95·12	55×1·1	2500	450·00	232	95·12
48·0	29	11·60	233	95·53	55×1·1	2504	450·72	233	95·53
48·1	29	11·60	233	95·53	55×1·1	2509	451·62	233	95·53
48·2	29	11·60	234	95·94	55×1·1	2514	452·52	234	95·94
48·3	29	11·60	235	96·35	55×1·1	2518	453·24	235	96·35
48·4	30	12·00	235	96·35	55×1·1	2523	454·14	235	96·35
48·5	30	12·00	236	96·76	55×1·1	2527	454·86	236	96·76
48·6	30	12·00	236	96·76	55×1·1	2532	455·76	236	96·76
48·7	30	12·00	237	97·17	55×1·1	2537	456·66	237	97·17
48·8	30	12·00	237	97·17	55×1·1	2541	457·38	237	97·17
48·9	30	12·00	238	97·58	55×1·1	2546	458·28	238	97·58
49·0	30	12·00	238	97·58	55×1·1	2550	459·00	238	97·58
49·1	30	12·00	239	97·99	55×1·1	2555	459·90	239	97·99
49·2	30	12·00	240	98·40	55×1·1	2560	460·80	240	98·40
49·3	30	12·00	240	98·40	55×1·1	2564	461·52	240	98·40
49·4	30	12·00	241	98·81	55×1·1	2569	462·42	241	98·81
49·5	30	12·00	242	99·22	55×1·1	2573	463·14	242	99·22
49·6	30	12·00	242	99·22	55×1·1	2578	464·04	242	99·22
49·7	30	12·00	243	99·63	55×1·1	2583	464·94	243	99·63
49·8	30	12·00	243	99·63	55×1·1	2588	465·84	243	99·63
49·9	30	12·00	244	100·04	55×1·1	2592	466·56	244	100·04
50·0	30	12·00	244	100·04	55×1·1	2597	467·46	244	100·04
50·1	31	12·40	245	100·45	55×1·1	2601	468·18	245	100·45
50·2	31	12·40	245	100·45	55×1·1	2606	469·08	245	100·45
50·3	31	12·40	246	100·86	55×1·1	2611	469·98	246	100·86
50·4	31	12·40	247	101·27	55×1·1	2615	470·70	247	101·27
50·5	31	12·40	247	101·27	55×1·1	2620	471·60	247	101·27
50·6	31	12·40	248	101·68	55×1·1	2624	472·32	248	101·68
50·7	31	12·40	248	101·68	55×1·1	2629	473·22	248	101·68
50·8	31	12·40	249	102·09	55×1·1	2634	474·12	249	102·09
50·9	31	12·40	250	102·50	55×1·1	2638	474·84	250	102·50
51·0	31	12·40	251	102·91	55×1·1	2643	475·74	251	102·91
51·1	31	12·40	251	102·91	55×1·1	2648	476·64	251	102·91
51·2	31	12·40	251	102·91	55×1·1	2652	477·36	251	102·91
51·3	31	12·40	252	103·32	55×1·1	2657	478·26	252	103·32

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
363	23·96	182	11·47	3477	673·99	16·85	120	90	900·84	46·8
363	23·96	182	11·47	3481	674·71	16·86	120	90	901·57	46·9
365	24·10	183	11·53	3491	676·63	16·91	120	90	903·54	47·0
365	24·10	183	11·53	3496	677·53	16·94	120	90	904·47	47·1
367	24·23	184	11·60	3505	679·18	16·98	120	90	906·16	47·2
367	24·23	184	11·60	3510	680·17	17·00	120	90	907·17	47·3
368	24·29	184	11·60	3518	681·95	17·05	120	90	909·00	47·4
368	24·29	184	11·60	3522	682·67	17·07	120	90	909·74	47·5
370	24·42	185	11·66	3532	684·58	17·12	120	90	911·70	47·6
370	24·42	185	11·66	3536	685·30	17·14	120	90	912·44	47·7
372	24·56	186	11·73	3546	687·23	17·18	120	90	914·41	47·8
372	24·56	186	11·73	3551	688·13	17·20	120	90	915·33	47·9
373	24·62	187	11·79	3559	689·79	17·25	120	90	917·04	48·0
373	24·62	187	11·79	3564	690·69	17·27	120	90	917·96	48·1
375	24·75	188	11·85	3574	692·60	17·31	120	90	919·91	48·2
376	24·82	188	11·85	3581	694·21	17·35	120	90	921·56	48·3
376	24·82	188	11·85	3587	695·61	17·39	120	90	923·00	48·4
378	24·95	189	11·91	3596	697·24	17·43	120	90	924·67	48·5
378	24·95	189	11·91	3601	698·14	17·45	120	90	925·59	48·6
380	25·08	190	11·98	3611	700·06	17·50	120	90	927·56	48·7
380	25·08	190	11·98	3615	700·78	17·52	120	90	928·30	48·8
381	25·15	191	12·04	3624	702·63	17·56	120	90	930·19	48·9
381	25·15	191	12·04	3628	703·35	17·58	120	90	930·93	49·0
383	25·28	192	12·10	3638	705·26	17·63	120	90	932·89	49·1
384	25·35	192	12·10	3646	707·05	17·67	120	90	934·72	49·2
384	25·35	192	12·10	3651	707·77	17·70	120	90	935·47	49·3
386	25·48	193	12·17	3660	709·69	17·74	120	90	937·43	49·4
388	25·61	194	12·23	3669	711·42	17·78	120	90	939·20	49·5
388	25·61	194	12·23	3674	712·32	17·80	120	90	940·12	49·6
389	25·67	195	12·29	3683	714·09	17·85	120	90	941·94	49·7
389	25·67	195	12·29	3688	714·99	17·87	120	90	942·86	49·8
391	25·82	196	12·35	3697	716·81	17·92	120	90	944·73	49·9
391	25·82	196	12·35	3702	717·71	17·94	120	90	945·56	50·0
392	25·87	196	12·35	3710	719·70	17·99	120	90	947·69	50·1
392	25·87	196	12·35	3715	720·70	18·02	120	90	948·72	50·2
394	26·01	197	12·41	3725	722·52	18·06	120	90	950·58	50·3
396	26·14	198	12·48	3734	724·27	18·10	120	90	952·37	50·4
396	26·14	198	12·48	3739	725·16	18·13	120	90	953·29	50·5
397	26·20	199	12·54	3747	726·82	18·17	120	90	954·99	50·6
397	26·20	199	12·54	3752	727·72	18·19	120	90	955·91	50·7
399	26·34	200	12·60	3762	729·64	18·24	120	90	957·88	50·8
400	26·40	200	12·60	3769	731·24	18·28	120	90	959·52	50·9
402	26·54	201	12·66	3779	733·16	18·33	120	90	961·49	51·0
402	26·54	201	12·66	3784	734·10	18·35	125	93·75	971·20	51·1
402	26·54	201	12·66	3788	734·78	18·37	125	93·75	971·90	51·2
404	26·67	202	12·73	3798	736·70	18·41	125	93·75	973·86	51·3

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
51·4	31	12·40	252	103·32	55×1·1	2661	478·98	252	103·32
51·5	31	12·40	253	103·73	55×1·1	2666	479·88	253	103·73
51·6	31	12·40	253	103·73	55×1·1	2671	480·78	253	103·73
51·7	32	12·80	254	104·14	55×1·1	2675	481·50	254	104·14
51·8	32	12·80	254	104·14	55×1·1	2680	482·40	254	104·14
51·9	32	12·80	255	104·55	55×1·1	2684	483·12	255	104·55
52·0	32	12·80	255	104·55	55×1·1	2689	484·02	255	104·55
52·1	32	12·80	256	104·96	55×1·1	2694	484·92	256	104·96
52·2	32	12·80	256	104·96	55×1·1	2698	485·62	256	104·96
52·3	32	12·80	257	105·37	55×1·1	2703	486·54	257	105·37
52·4	32	12·80	258	105·78	55×1·1	2707	487·26	258	105·78
52·5	32	12·80	258	105·78	55×1·1	2712	488·16	258	105·78
52·6	32	12·80	259	106·19	55×1·1	2717	489·06	259	106·19
52·7	32	12·80	259	106·19	55×1·1	2722	489·96	259	106·19
52·8	32	12·80	260	106·60	55×1·1	2726	490·68	260	106·60
52·9	32	12·80	260	106·60	55×1·1	2731	491·58	260	106·60
53·0	32	12·80	261	107·01	55×1·1	2736	492·48	261	107·01
53·1	32	12·80	262	107·42	55×1·1	2740	493·20	262	107·42
53·2	32	12·80	262	107·42	55×1·1	2745	494·10	262	107·42
53·3	32	12·80	263	107·83	55×1·1	2749	494·82	263	107·83
53·4	33	13·20	263	107·83	55×1·1	2754	495·72	263	107·83
53·5	33	13·20	264	108·24	55×1·1	2758	496·44	264	108·24
53·6	33	13·20	264	108·24	55×1·1	2763	497·34	264	108·24
53·7	33	13·20	265	108·65	55×1·1	2768	498·24	265	108·65
53·8	33	13·20	265	108·65	55×1·1	2772	498·96	265	108·65
53·9	33	13·20	266	109·06	55×1·1	2777	499·86	266	109·06
54·0	33	13·20	266	109·06	55×1·1	2781	500·58	266	109·06
54·1	33	13·20	267	109·47	55×1·1	2786	501·48	267	109·47
54·2	33	13·20	268	109·88	55×1·1	2791	502·38	268	109·88
54·3	33	13·20	268	109·88	55×1·1	2795	503·16	268	109·88
54·4	33	13·20	269	110·29	55×1·1	2800	504·06	269	110·29
54·5	33	13·20	270	110·70	55×1·1	2805	504·96	270	110·70
54·6	33	13·20	270	110·70	55×1·1	2809	505·68	270	110·70
54·7	33	13·20	271	111·11	55×1·1	2814	506·58	271	111·11
54·8	33	13·20	271	111·11	55×1·1	2818	507·30	271	111·11
54·9	33	13·20	272	111·52	55×1·1	2823	508·20	272	111·52
55·0	33	13·20	272	111·52	55×1·1	2828	509·10	272	111·52
55·1	34	13·60	273	111·93	55×1·1	2832	509·82	273	111·93
55·2	34	13·60	273	111·93	55×1·1	2837	510·72	273	111·93
55·3	34	13·60	274	112·34	55×1·1	2842	511·62	274	112·34
55·4	34	13·60	274	112·34	55×1·1	2846	512·28	274	112·34
55·5	34	13·60	275	112·75	55×1·1	2851	513·18	275	112·75
55·6	34	13·60	275	112·75	55×1·1	2855	513·90	275	112·75
55·7	34	13·60	276	113·16	55×1·1	2860	514·80	276	113·16
55·8	34	13·60	276	113·16	55×1·1	2865	515·70	276	113·16
55·9	34	13·60	277	113·57	55×1·1	2869	516·42	277	113·57

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste $2\frac{1}{2}$ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
404	26·67	202	12·73	3802	737·42	18·43	125	93·75	974·60	51·4
405	26·74	203	12·79	3811	739·27	18·48	125	93·75	976·50	51·5
405	26·74	203	12·79	3816	740·17	18·50	125	93·75	977·42	51·6
407	26·86	204	12·85	3826	742·29	18·56	125	93·75	979·60	51·7
407	26·86	204	12·85	3831	743·19	18·58	125	93·75	980·52	51·8
408	26·93	204	12·85	3838	744·80	18·62	125	93·75	982·17	51·9
408	26·93	204	12·85	3843	745·70	18·64	125	93·75	983·09	52·0
410	27·06	205	12·92	3853	747·62	18·69	125	93·75	985·06	52·1
410	27·06	205	12·92	3857	748·34	18·71	125	93·75	985·80	52·2
411	27·13	206	12·98	3866	750·19	18·75	125	93·75	987·69	52·3
413	27·26	207	13·04	3875	751·93	18·80	125	93·75	989·48	52·4
413	27·26	207	13·04	3880	752·81	18·82	125	93·75	990·38	52·5
415	27·40	208	13·11	3890	754·75	18·87	125	93·75	992·37	52·6
415	27·40	208	13·11	3895	755·65	18·89	125	93·75	993·29	52·7
416	27·46	208	13·11	3902	757·25	18·93	125	93·76	994·93	52·8
416	27·46	208	13·11	3907	758·15	18·95	125	93·75	995·85	52·9
418	27·59	209	13·17	3917	760·06	19·00	125	93·75	997·81	53·0
420	27·73	210	13·23	3926	761·80	19·05	130	97·50	1008·35	53·1
420	27·73	210	13·23	3931	763·70	19·09	130	97·50	1010·29	53·2
421	27·79	211	13·30	3939	764·37	19·11	130	97·50	1010·98	53·3
421	27·79	211	13·30	3945	765·67	19·14	130	97·50	1012·31	53·4
423	27·92	212	13·36	3954	767·40	19·18	130	97·50	1014·08	53·5
423	27·92	212	13·36	3959	768·30	19·21	130	97·50	1015·01	53·6
424	27·99	212	13·36	3967	770·09	19·25	130	97·50	1016·84	53·7
424	27·99	212	13·36	3971	770·81	19·27	130	97·50	1017·58	53·8
426	28·13	213	13·42	3981	772·73	19·32	130	97·50	1019·55	53·9
426	28·13	213	13·42	3985	773·45	19·34	130	97·50	1020·29	54·0
428	28·25	214	13·48	3995	775·35	19·38	130	97·50	1022·23	54·1
429	28·32	215	13·55	4004	777·31	19·43	130	97·50	1024·24	54·2
429	28·32	215	13·55	4008	777·99	19·45	130	97·50	1024·94	54·3
431	28·45	216	13·61	4018	779·90	19·50	130	97·50	1026·90	54·4
432	28·52	216	13·61	4026	781·69	19·54	130	97·50	1028·73	54·5
432	28·52	216	13·61	4030	782·41	19·56	130	97·50	1029·47	54·6
434	28·65	217	13·67	4040	784·32	19·61	130	97·50	1031·43	54·7
434	28·65	217	13·67	4044	785·04	19·62	130	97·50	1032·16	54·8
436	28·78	218	13·74	4054	786·96	19·67	130	97·50	1034·13	54·9
436	28·78	218	13·74	4059	787·86	19·70	130	97·50	1035·06	55·0
437	28·85	219	13·80	4068	789·93	19·75	135	101·25	1045·93	55·1
437	28·85	219	13·80	4073	790·83	19·77	135	101·25	1046·85	55·2
439	28·98	220	13·86	4083	792·74	19·82	135	101·25	1048·81	55·3
439	28·98	220	13·86	4087	793·40	19·84	135	101·25	1049·49	55·4
440	29·04	220	13·86	4095	795·18	19·88	135	101·25	1051·31	55·5
440	29·04	220	13·86	4099	795·90	19·90	135	101·25	1052·05	55·6
442	29·17	221	13·93	4109	797·82	19·95	135	101·25	1054·02	55·7
442	29·17	221	13·93	4114	798·72	19·97	135	101·25	1054·94	55·8
444	29·30	222	13·99	4123	800·45	20·01	135	101·25	1056·71	55·9

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
56·0	34	13·60	278	113·98	55×1·1	2874	517·32	278	113·98
56·1	34	13·60	279	114·39	55×1·1	2878	518·04	279	114·39
56·2	34	13·60	279	114·39	55×1·1	2883	518·94	279	114·39
56·3	34	13·60	280	114·80	55×1·1	2888	519·84	280	114·80
56·4	34	13·60	280	114·80	55×1·1	2892	520·56	280	114·80
56·5	34	13·60	281	115·21	55×1·1	2897	521·46	281	115·21
56·6	34	13·60	281	115·21	55×1·1	2901	522·18	281	115·21
56·7	35	14·00	282	115·62	55×1·1	2906	523·08	282	115·62
56·8	35	14·00	283	116·03	55×1·1	2911	523·98	283	116·03
56·9	35	14·00	283	116·03	55×1·1	2916	524·88	283	116·03
57·0	35	14·00	284	116·44	55×1·1	2920	525·60	284	116·44
57·1	35	14·00	284	116·44	55×1·1	2925	526·50	284	116·44
57·2	35	14·00	285	116·85	55×1·1	2929	527·22	285	116·85
57·3	35	14·00	286	117·26	55×1·1	2934	528·12	286	117·26
57·4	35	14·00	286	117·26	55×1·1	2939	529·02	286	117·26
57·5	35	14·00	287	117·67	55×1·1	2943	529·74	287	117·67
57·6	35	14·00	287	117·67	55×1·1	2948	530·64	287	117·67
57·7	35	14·00	288	118·08	55×1·1	2952	531·36	288	118·08
57·8	35	14·00	288	118·08	55×1·1	2957	532·26	288	118·08
57·9	35	14·00	289	118·49	55×1·1	2962	533·16	289	118·49
58·0	35	14·00	290	118·90	55×1·1	2966	533·88	290	118·90
58·1	35	14·00	290	118·90	55×1·1	2971	534·78	290	118·90
58·2	35	14·00	291	119·31	55×1·1	2976	535·68	291	119·31
58·3	35	14·00	291	119·31	55×1·1	2980	536·40	291	119·31
58·4	36	14·40	292	119·72	55×1·1	2985	537·30	292	119·72
58·5	36	14·40	292	119·72	55×1·1	2989	538·02	292	119·72
58·6	36	14·40	293	120·13	55×1·1	2994	538·74	293	120·13
58·7	36	14·40	293	120·13	55×1·1	2999	539·82	293	120·13
58·8	36	14·40	294	120·54	55×1·1	3003	540·54	294	120·54
58·9	36	14·40	294	120·54	55×1·1	3008	541·44	294	120·54
59·0	36	14·40	295	120·95	55×1·1	3012	542·16	295	120·95
59·1	36	14·40	296	121·36	55×1·1	3017	543·06	296	121·36
59·2	36	11·40	296	121·36	55×1·1	3022	543·96	296	121·36
59·3	36	14·40	297	121·77	55×1·1	3026	544·68	297	121·77
59·4	36	14·40	297	121·77	55×1·1	3031	545·58	297	121·77
59·5	36	14·40	298	122·18	55×1·1	3035	546·30	298	122·18
59·6	36	14·40	298	122·18	55×1·1	3040	547·20	298	122·18
59·7	36	14·40	299	122·59	55×1·1	3045	548·10	299	122·59
59·8	36	14·40	299	122·59	55×1·1	3049	548·82	299	122·59
59·9	36	14·40	300	123·00	55×1·1	3054	549·72	300	123·00
60·0	36	14·40	300	123·00	55×1·1	3059	550·62	300	123·00
60·1	37	14·80	301	123·41	55×1·1	3063	551·34	301	123·41
60·2	37	14·80	302	123·82	55×1·1	3068	552·24	302	123·82
60·3	37	14·80	303	124·23	55×1·1	3072	552·96	303	124·23
60·4	37	14·80	303	124·23	55×1·1	3077	553·86	303	124·23
60·5	37	14·80	303	124·23	55×1·1	3081	554·58	303	124·23
60·6	37	14·80	304	124·64	55×1·1	3086	555·48	304	124·64

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste $2\frac{1}{2}$ per cent., shillings	Wages, shillings	Shop Expenses shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
445	29·37	223	14·05	4132	802·30	20·05	135	101·25	1058·60	56·0
447	29·50	224	14·12	4141	804·04	20·10	135	101·25	1060·39	56·1
447	29·50	224	14·12	4146	805·94	20·15	135	101·25	1062·34	56·2
448	29·57	224	14·12	4154	806·73	20·17	135	101·25	1063·15	56·3
448	29·57	224	14·12	4158	807·46	20·19	135	101·25	1063·90	56·4
450	29·70	225	14·18	4168	809·36	20·24	135	101·25	1065·85	56·5
450	29·70	225	14·18	4172	810·08	20·25	135	101·25	1066·58	56·6
452	29·84	226	14·25	4183	812·41	20·31	135	101·25	1068·97	56·7
453	29·90	227	14·31	4192	814·25	20·35	135	101·25	1070·85	56·8
453	29·90	227	14·31	4197	815·15	20·38	135	101·25	1071·78	56·9
455	30·03	228	14·37	4206	816·88	20·42	135	101·25	1073·55	57·0
455	30·03	228	14·37	4211	817·78	20·45	140	105·00	1083·23	57·1
456	30·10	228	14·37	4218	819·59	20·49	140	105·00	1085·08	57·2
458	30·22	229	14·44	4228	821·30	20·53	140	105·00	1086·83	57·3
458	30·22	229	14·44	4233	822·20	20·55	140	105·00	1087·75	57·4
460	30·36	230	14·50	4242	823·94	20·60	140	105·00	1089·54	57·5
460	30·36	230	14·50	4247	824·84	20·62	140	105·00	1090·46	57·6
461	30·43	231	14·56	4255	826·51	20·66	140	105·00	1092·17	57·7
461	30·43	231	14·56	4260	827·41	20·68	140	105·00	1093·09	57·8
463	30·56	232	14·63	4270	829·33	20·73	140	105·00	1095·06	57·9
464	30·62	232	14·63	4277	830·93	20·77	140	105·00	1096·70	58·0
464	30·62	232	14·63	4282	831·83	20·80	150	112·50	1115·13	58·1
466	30·76	233	14·69	4292	833·75	20·84	150	112·50	1117·09	58·2
466	30·76	233	14·69	4296	834·47	20·86	150	112·50	1117·83	58·3
467	30·82	234	14·75	4306	836·31	20·91	150	112·50	1119·72	58·4
467	30·82	234	14·75	4310	837·43	20·94	150	112·50	1120·87	58·5
469	30·96	235	14·81	4320	839·17	20·98	150	112·50	1122·65	58·6
469	30·96	235	14·81	4325	840·25	21·00	150	112·50	1123·75	58·7
471	31·09	236	14·87	4334	841·58	21·04	150	112·50	1125·12	58·8
471	31·09	236	14·87	4339	842·88	21·07	150	112·50	1126·45	58·9
472	31·16	236	14·87	4346	844·49	21·11	150	112·50	1128·10	59·0
474	31·29	237	14·93	4356	846·40	21·16	150	112·50	1130·06	59·1
474	31·29	237	14·93	4361	847·30	21·18	150	112·50	1130·98	59·2
476	31·42	238	15·00	4370	849·04	21·22	150	112·50	1132·76	59·3
476	31·42	238	15·00	4375	849·94	21·25	150	112·50	1133·69	59·4
477	31·49	239	15·06	4383	851·61	21·29	150	112·50	1135·40	59·5
477	31·49	239	15·06	4388	852·51	21·31	150	112·50	1136·32	59·6
479	31·62	240	15·13	4398	854·43	21·36	150	112·50	1138·29	59·7
479	31·62	240	15·13	4402	855·15	21·38	150	112·50	1139·03	59·8
480	31·69	240	15·13	4410	856·94	21·42	150	112·50	1140·86	59·9
480	31·69	240	15·13	4415	857·84	21·44	150	112·50	1141·78	60·0
482	31·82	241	15·19	4425	859·97	21·50	150	112·50	1142·97	60·1
484	31·95	242	15·25	4435	861·88	21·55	150	112·50	1145·93	60·2
485	32·01	243	15·31	4443	863·54	21·58	150	112·50	1147·62	60·3
485	32·01	243	15·31	4448	864·44	21·61	150	112·50	1148·55	60·4
485	32·01	243	15·31	4452	865·16	21·63	150	112·50	1149·29	60·5
487	32·14	244	15·38	4462	866·73	21·66	150	112·50	1150·89	60·6

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings
60·7	37	14·80	304	124·64	55×1·1	3091	556·38	304	124·64
60·8	37	14·80	305	125·05	55×1·1	3096	557·28	305	125·05
60·9	37	14·80	306	125·46	55×1·1	3100	558·00	306	125·46
61·0	37	14·80	306	125·46	55×1·1	3105	558·90	306	125·46
61·1	37	14·80	307	125·87	55×1·1	3109	559·62	307	125·87
61·2	37	14·80	307	125·87	55×1·1	3114	560·52	307	125·87
61·3	37	14·80	308	126·28	55×1·1	3118	561·24	308	126·28
61·4	37	14·80	308	126·28	55×1·1	3123	562·14	308	126·28
61·5	37	14·80	309	126·69	55×1·1	3128	563·04	309	126·69
61·6	37	14·80	310	127·10	55×1·1	3132	563·76	310	127·10
61·7	38	15·20	310	127·10	55×1·1	3137	564·66	310	127·10
61·8	38	15·20	311	127·51	55×1·1	3141	565·38	311	127·51
61·9	38	15·20	311	127·51	55×1·1	3146	566·28	311	127·51
62·0	38	15·20	312	127·92	55×1·1	3151	567·18	312	127·92
62·1	38	15·20	312	127·92	55×1·1	3155	567·90	312	127·92
62·2	38	15·20	313	128·32	55×1·1	3160	568·80	313	128·32
62·3	38	15·20	313	128·32	55×1·1	3164	569·52	313	128·32
62·4	38	15·20	314	128·74	55×1·1	3169	570·42	314	128·74
62·5	38	15·20	314	128·74	55×1·1	3174	571·32	314	128·74
62·6	38	15·20	315	129·15	55×1·1	3178	572·04	315	129·15
62·7	38	15·20	316	129·56	55×1·1	3183	572·94	316	129·56
62·8	38	15·20	316	129·56	55×1·1	3188	573·84	316	129·56
62·9	38	15·20	317	129·97	55×1·1	3192	574·56	317	129·97
63·0	38	15·20	317	129·97	55×1·1	3197	575·46	317	129·97
63·1	38	15·20	318	130·38	55×1·1	3201	576·18	318	130·38
63·2	38	15·20	318	130·38	55×1·1	3206	577·08	318	130·38
63·3	38	15·20	319	130·79	55×1·1	3210	577·80	319	130·79
63·4	39	15·60	320	131·20	55×1·1	3216	578·88	320	131·20
63·5	39	15·60	320	131·20	55×1·1	3220	579·60	320	131·20
63·6	39	15·60	321	131·61	55×1·1	3225	580·50	321	131·61
63·7	39	15·60	321	131·61	55×1·1	3230	581·40	321	131·61
63·8	39	15·60	322	132·02	55×1·1	3234	582·12	322	132·02
63·9	39	15·60	322	132·02	55×1·1	3238	582·84	322	133·02
64·0	39	15·60	323	132·43	55×1·1	3243	583·74	323	132·43
64·1	39	15·60	323	132·43	55×1·1	3248	584·64	323	132·43
64·2	39	15·60	324	132·84	55×1·1	3252	585·36	324	132·84
64·3	39	15·60	324	132·84	55×1·1	3257	586·26	324	132·84
64·4	39	15·60	325	133·25	55×1·1	3261	586·98	325	133·25
64·5	39	15·60	326	133·66	55×1·1	3266	587·88	326	133·66
64·6	39	15·60	326	133·66	55×1·1	3271	588·78	326	133·66
64·7	39	15·60	327	134·07	55×1·1	3276	589·68	327	134·07
64·8	39	15·60	328	134·48	55×1·1	3280	590·40	328	134·48
64·9	39	15·60	328	134·48	55×1·1	3285	591·30	328	134·48
65·0	39	15·60	329	134·89	55×1·1	3290	592·20	329	134·89
65·1	40	16	329	134·89	55×1·1	3294	592·92	329	134·89
65·2	40	16	330	135·30	55×1·1	3299	593·82	330	135·30
65·3	40	16	330	135·30	55×1·1	3303	594·54	330	135·30

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of Materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
487	32·14	244	15·38	4467	867·98	21·70	150	112·50	1152·18	60·7
488	32·21	244	15·38	4475	869·77	21·74	150	112·50	1154·01	60·8
490	32·35	245	15·44	4484	871·51	21·78	150	112·50	1155·79	60·9
490	32·35	245	15·44	4489	872·41	21·81	150	112·50	1156·72	61·0
492	32·48	246	15·50	4498	874·14	21·85	150	112·50	1158·49	61·1
492	32·48	246	15·50	4503	875·04	21·88	150	112·50	1159·42	61·2
493	32·54	247	15·57	4511	876·71	21·91	150	112·50	1161·12	61·3
493	32·54	247	15·57	4516	877·61	21·94	150	112·50	1162·05	61·4
495	32·67	248	15·63	4526	879·52	21·99	150	112·50	1164·01	61·5
496	32·74	248	15·63	4533	881·13	22·03	150	112·50	1165·66	61·6
496	32·74	248	15·63	4539	882·43	22·06	150	112·50	1166·99	61·7
498	32·87	249	15·69	4547	884·16	22·10	155	116·50	1177·76	61·8
498	32·87	249	15·69	4553	885·06	22·13	155	116·50	1178·69	61·9
500	33·00	250	15·75	4563	886·97	22·17	155	116·50	1180·64	62·0
500	33·00	250	15·75	4567	887·69	22·19	155	116·50	1181·38	62·1
501	33·07	251	15·82	4576	889·55	22·24	155	116·50	1183·29	62·2
501	33·07	251	15·82	4580	890·27	22·26	155	116·50	1184·03	62·3
503	33·20	252	15·88	4590	892·18	22·30	155	116·50	1185·98	62·4
503	33·20	252	15·88	4595	893·08	22·32	155	116·50	1186·90	62·5
504	33·26	252	15·88	4602	894·68	22·37	155	116·50	1188·55	62·6
506	33·33	253	15·94	4612	896·53	22·41	155	116·50	1190·44	62·7
506	33·33	253	15·94	4617	897·43	22·43	155	116·50	1191·36	62·8
507	33·46	254	16·00	4625	899·16	22·48	155	116·50	1193·14	62·9
507	33·46	254	16·00	4630	900·06	22·50	155	116·50	1194·06	63·0
509	33·60	255	16·07	4639	901·81	22·54	155	116·50	1195·85	63·1
509	33·60	255	16·07	4644	902·71	22·56	155	116·50	1196·77	63·2
511	33·73	256	16·13	4653	904·44	22·61	155	116·50	1198·55	63·3
512	33·80	256	16·13	4663	905·81	22·64	155	116·50	1199·95	63·4
512	33·80	256	16·13	4667	907·53	22·69	155	116·50	1201·72	63·5
514	33·93	257	16·20	4677	909·45	22·73	155	116·50	1203·68	63·6
514	33·93	257	16·20	4682	910·34	22·75	155	116·50	1204·59	63·7
516	34·06	258	16·26	4691	912·08	22·80	160	120	1214·88	63·8
516	34·06	258	16·26	4695	912·80	22·82	160	120	1215·62	63·9
517	34·13	259	16·32	4704	914·65	22·87	160	120	1217·52	64·0
517	34·13	259	16·32	4709	915·54	22·88	160	120	1218·42	64·1
519	34·26	260	16·38	4717	917·22	22·93	160	120	1220·15	64·2
519	34·26	260	16·38	4722	918·12	22·95	160	120	1221·07	64·3
520	34·32	260	16·38	4730	919·78	23·00	160	120	1222·78	64·4
522	34·45	261	16·45	4740	921·70	23·04	160	120	1224·74	64·5
522	34·45	261	16·45	4745	922·60	23·07	160	120	1225·67	64·6
524	34·59	262	16·51	4755	924·52	23·11	160	120	1227·63	64·7
525	34·65	263	16·57	4763	926·18	23·15	160	120	1229·33	64·8
525	34·65	263	16·57	4768	927·08	23·18	160	120	1230·26	64·9
527	34·79	264	16·64	4778	928·98	23·22	160	120	1232·20	65·0
527	34·79	264	16·64	4783	930·13	23·25	160	120	1233·38	65·1
528	34·85	264	16·64	4791	931·91	23·30	160	120	1235·21	65·2
528	34·85	264	16·64	4795	932·63	23·32	160	120	1235·95	65·3

TABLE No. 129.—STEEL TAPE ARMOUR.

Diam. over Lead, mm.	Paper		Jute		Steel Tape			Jute	
	Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings	Dimensions, mm.	Kilog. per km.	Price, shillings	Kilog. per mm.	Price, shillings
65·4	40	16	331	135·71	55×1·1	3308	595·44	331	135·71
65·5	40	16	331	135·71	55×1·1	3312	596·16	331	135·71
65·6	40	16	332	136·12	55×1·1	3317	597·06	332	136·12
65·7	40	16	332	136·12	55×1·1	3322	597·96	332	136·12
65·8	40	16	333	136·53	55×1·1	3326	598·68	333	136·53
65·9	40	16	334	136·94	55×1·1	3331	599·58	334	136·94
66·0	40	16	334	136·94	55×1·1	3336	600·48	334	136·94
66·1	40	16	335	137·35	55×1·1	3340	601·20	335	137·35
66·2	40	16	335	137·35	55×1·1	3345	602·10	335	137·35
66·3	40	16	336	137·76	55×1·1	3350	603·00	336	137·76
66·4	40	16	336	137·76	55×1·1	3354	603·72	336	137·76
66·5	40	16	337	138·17	55×1·1	3359	604·62	337	138·17
66·6	40	16	338	138·61	55×1·1	3363	605·34	338	138·61
66·7	41	16·40	338	138·61	55×1·1	3368	606·24	338	138·61
66·8	41	16·40	339	139·02	55×1·1	3372	606·96	339	139·02
66·9	41	16·40	339	139·02	55×1·1	3377	607·86	339	139·02
67·0	41	16·40	340	139·43	55×1·1	3382	608·76	340	139·43
67·1	41	16·40	340	139·43	55×1·1	3386	609·48	340	139·43
67·2	41	16·40	341	139·84	55×1·1	3391	610·38	341	139·84
67·3	41	16·40	341	139·84	55×1·1	3396	611·28	341	139·84
67·4	41	16·40	342	140·25	55×1·1	3400	612·00	342	140·25
67·5	41	16·40	343	140·66	55×1·1	3405	612·90	343	140·66
67·6	41	16·40	343	140·66	55×1·1	3410	613·80	343	140·66
67·7	41	16·40	344	141·04	55×1·1	3414	614·52	344	141·04
67·8	41	16·40	345	141·45	55×1·1	3419	615·42	345	141·45
67·9	41	16·40	346	141·86	55×1·1	3423	616·14	346	141·86
68·0	41	16·40	346	141·86	55×1·1	3428	617·04	346	141·86
68·1	41	16·40	347	142·27	55×1·1	3432	617·76	347	142·27
68·2	41	16·40	347	142·27	55×1·1	3437	618·66	347	142·27
68·3	41	16·40	348	142·68	55×1·1	3442	619·56	348	142·68
68·4	41	16·40	348	142·68	55×1·1	3446	620·28	348	142·68
68·5	41	16·40	349	143·09	55×1·1	3451	621·18	349	143·09
68·6	41	16·40	349	143·09	55×1·1	3456	622·08	349	143·09
68·7	42	16·80	350	143·50	55×1·1	3460	622·80	350	143·50
68·8	12	16·80	350	143·50	55×1·1	3465	623·70	350	143·50
68·9	42	16·80	351	143·91	55×1·1	3469	624·42	351	143·91
69·0	42	16·80	351	143·91	55×1·1	3474	625·32	351	143·91
69·1	42	16·80	352	144·32	55×1·1	3479	626·22	352	144·32
69·2	42	16·80	353	144·73	55×1·1	3483	626·94	353	144·73
69·3	42	16·80	353	144·73	55×1·1	3488	627·84	353	144·73
69·4	42	16·80	354	145·14	55×1·1	3492	628·56	354	145·14
69·5	42	16·80	355	145·55	55×1·1	3497	629·46	355	145·55
69·6	42	16·80	356	145·96	55×1·1	3502	630·36	356	145·96
69·7	42	16·80	356	145·96	55×1·1	3507	631·26	356	145·96
69·8	42	16·80	357	146·37	55×1·1	3511	631·98	357	146·37
69·9	42	16·80	357	146·37	55×1·1	3516	632·88	357	146·37
70·0	42	16·80	358	146·78	55×1·1	3520	633·60	358	146·78

(All Weights and Prices are per Kilometre.)—*continued.*

Tar		Compound		Total Weight of materials, kilog. per km.	Total Price of Materials, shillings	Waste 2½ per cent., shillings	Wages, shillings	Shop Expenses, shillings	Total Price, shillings	Diam. over Lead, mm.
Kilog. per km.	Price, shillings	Kilog. per km.	Price, shillings							
530	34·98	265	16·70	4805	934·54	23·36	160	120	1237·90	65·4
530	34·98	265	16·70	4809	935·26	23·38	160	120	1238·64	65·5
532	35·12	266	16·76	4819	937·18	23·43	160	120	1240·61	65·6
532	35·12	266	16·76	4824	938·08	23·45	160	120	1241·53	65·7
533	35·18	267	16·83	4832	939·75	23·49	160	120	1243·24	65·8
535	35·32	268	16·89	4842	941·67	23·54	160	120	1245·21	65·9
535	35·32	268	16·89	4847	942·57	23·56	160	120	1246·13	66·0
536	35·38	268	16·89	4854	944·17	23·60	160	120	1247·77	66·1
536	35·38	268	16·89	4859	945·07	23·62	160	120	1248·69	66·2
538	35·51	269	16·95	4869	946·98	23·67	160	120	1250·65	66·3
538	35·51	269	16·95	4873	947·70	23·70	160	120	1251·40	66·4
540	35·65	270	17·01	4883	949·62	23·74	160	120	1253·36	66·5
541	35·72	271	17·08	4891	951·36	23·78	160	120	1255·14	66·6
541	35·72	271	17·08	4897	952·66	23·82	160	120	1256·48	66·7
543	35·84	272	17·14	4906	954·38	23·86	160	120	1258·24	66·8
543	35·84	272	17·14	4911	955·28	23·88	160	120	1259·16	66·9
544	35·91	272	17·14	4919	957·07	23·93	160	120	1261·00	67·0
544	35·91	272	17·14	4923	957·79	23·95	160	120	1261·74	67·1
546	36·04	273	17·20	4933	959·70	24·00	160	120	1263·70	67·2
546	36·04	273	17·20	4938	960·60	24·02	160	120	1264·62	67·3
548	36·17	274	17·27	4947	962·34	24·06	160	120	1266·40	67·4
549	36·24	275	17·33	4956	964·19	24·10	160	120	1268·29	67·5
549	36·24	275	17·33	4961	965·09	24·13	160	120	1269·22	67·6
551	36·37	276	17·39	4970	966·76	24·17	160	120	1270·93	67·7
552	36·44	276	17·39	4978	967·55	24·19	160	120	1271·74	67·8
554	36·57	277	17·46	4987	970·29	24·26	165	124	1283·55	67·9
554	36·57	277	17·46	4992	971·19	24·28	165	124	1284·47	68·0
556	36·70	278	17·52	5001	972·92	24·32	165	124	1286·24	68·1
556	36·70	278	17·52	5006	973·83	24·34	165	124	1287·17	68·2
557	36·76	279	17·58	5015	975·66	24·39	165	124	1289·05	68·3
557	36·76	279	17·58	5019	976·38	24·41	165	124	1289·79	68·4
559	36·90	280	17·65	5029	978·31	24·46	165	124	1291·77	68·5
559	36·90	280	17·65	5034	979·21	24·48	165	124	1292·69	68·6
560	36·96	280	17·65	5042	981·21	24·53	165	124	1294·74	68·7
560	36·96	280	17·65	5047	982·11	24·55	165	124	1295·66	68·8
562	37·10	281	17·71	5056	983·85	24·60	165	124	1297·45	68·9
562	37·10	281	17·71	5061	984·75	24·62	165	124	1298·37	69·0
564	37·22	282	17·77	5071	986·65	24·67	165	124	1300·32	69·1
565	37·30	283	17·83	5079	988·33	24·71	165	124	1302·04	69·2
565	37·30	283	17·83	5084	989·23	24·73	165	124	1302·96	69·3
567	37·42	284	17·90	5093	990·96	24·78	165	124	1304·74	69·4
568	37·49	284	17·90	5101	992·75	24·82	165	124	1306·57	69·5
570	37·62	285	17·96	5111	994·66	24·87	165	124	1308·53	69·6
570	37·62	285	17·96	5116	995·56	24·89	165	124	1309·45	69·7
572	37·76	286	18·02	5125	997·30	24·93	165	124	1311·23	69·8
572	37·76	286	18·02	5130	998·20	24·95	165	124	1312·15	69·9
573	37·82	287	18·08	5138	999·86	25·00	170	127·50	1322·36	70·0

TABLE No. 130.—APPROXIMATE PRICES OF MATERIALS.

Material	Price in Shillings per:— 100 kilogrammes	100 lb.
Paper	40·0	18·15
Jute yarns, 5 to 10 lb.	35 to 37·5	15·9 to 17·0
Gas tar.	4·43	2·01
Pitch	4·0	1·82
Resin oil	12·3	5·58
Steel tape	19·0	8·65
Galvanised steel tape	30·0	13·64
Compound (4 pitch to 1 gas tar)	4·1	1·86
Compound (3 pitch to 1 resin oil)	12·15	5·53

CHAPTER XI.

LABOUR CHARGES AND EXAMPLES.

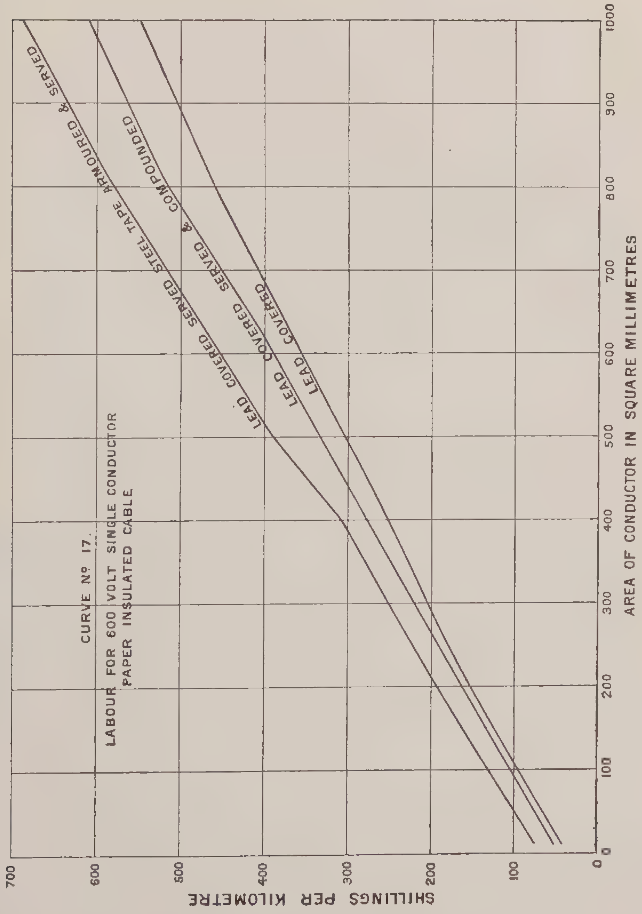
THE additions to be made to the price of the materials in order to arrive at the cost of a cable are:—(1) Labour; (2) waste of materials; (3) shop expenses; (4) carriage, discount, and profit. The fourth division need not be here considered.

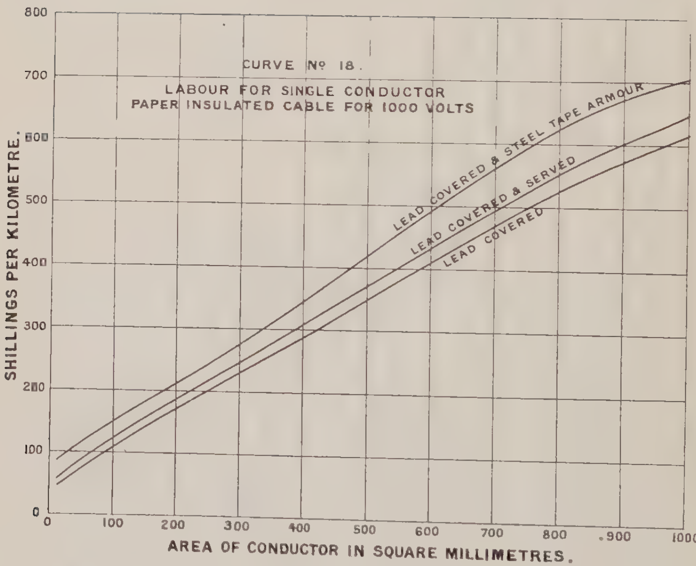
(1) *Labour.*—In the manufacture of cables in large works and with modern machinery the cost of the labour varies between 5 and 15 per cent. of the cost of the material. From the consideration of the actual costs of a large number of cables of various types, the cost of the labour is found to be approximately expressible by the percentage of the cost of material shown in Table No. 131. These percentages represent average values, and in the case of relatively short lengths of cable the cost of labour will be higher; whilst, on the other hand, for long lengths of cable, where a machine would run for several days without alteration, only requiring replenishment of material, the cost of the labour will be lower than that represented by these percentages.

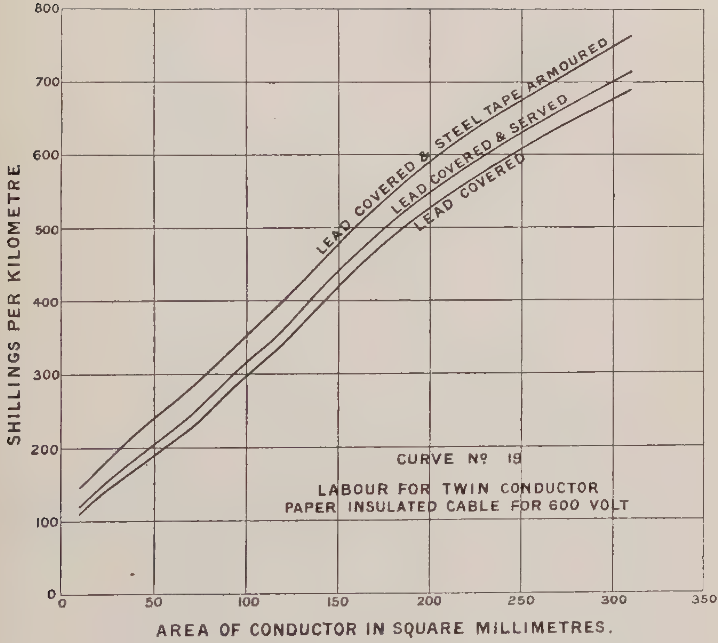
TABLE No. 131.—COST OF LABOUR.

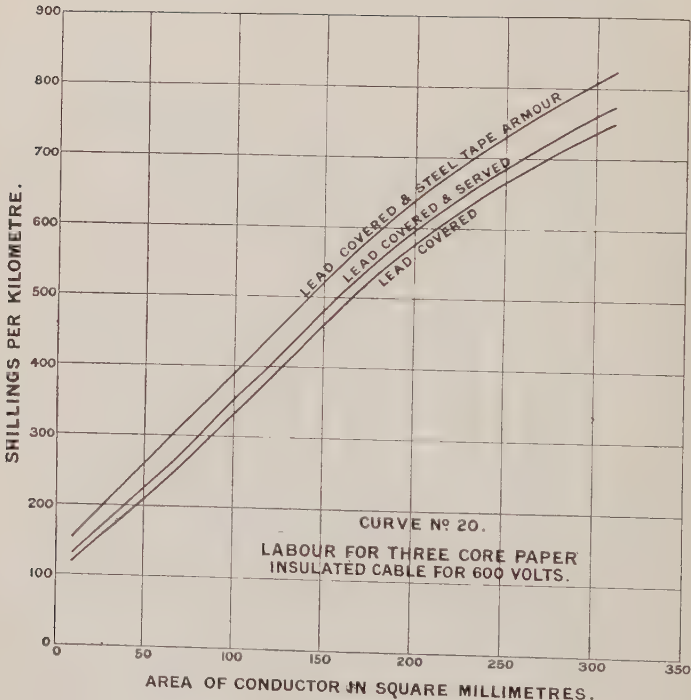
Type of Cable	Percentage of Cost of Material
Paper or jute insulated single conductor, lead sheathed and armoured	7·5 per cent.
Paper or jute insulated concentric conductors, lead sheathed and armoured	12 ,,
Paper or jute insulated multicore conductors, lead sheathed and armoured	10 ,,
Paper and air space telephone cables	12 ,,
Rubber insulated cables	10 ,,

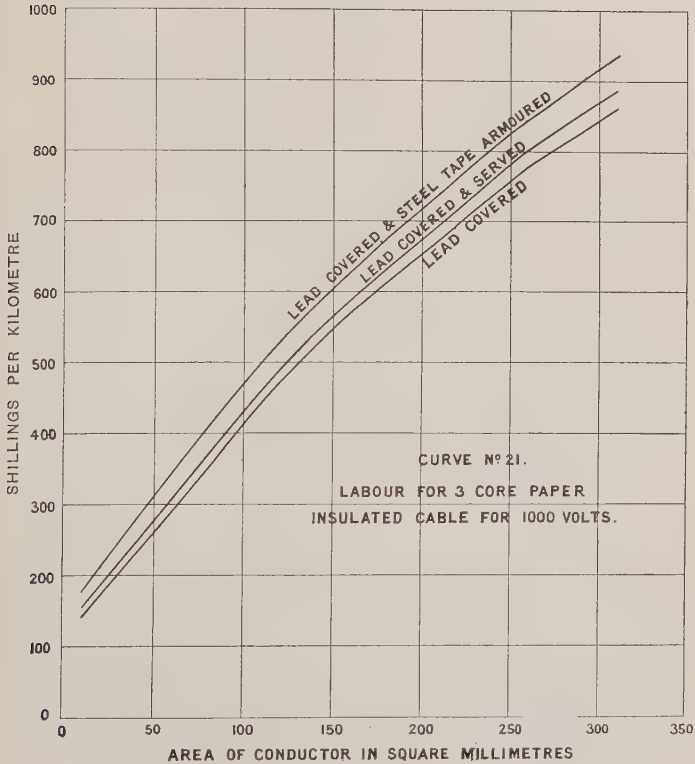
The following curves have been constructed from the actual costs of labour for cables of various types.



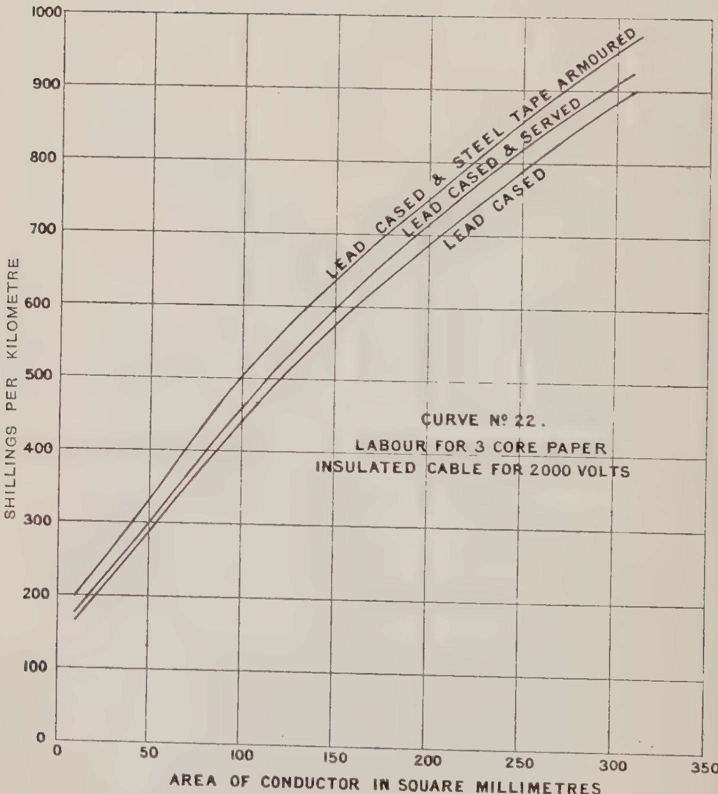

CURVE No. 18.
LABOUR FOR SINGLE CONDUCTOR
PAPER INSULATED CABLE FOR 1000 VOLTS
LEAD COVERED & STEEL TAPE ARMOUR
LEAD COVERED & SERVED
LEAD COVERED
SHILLINGS PER KILOMETRE.
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1000
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.

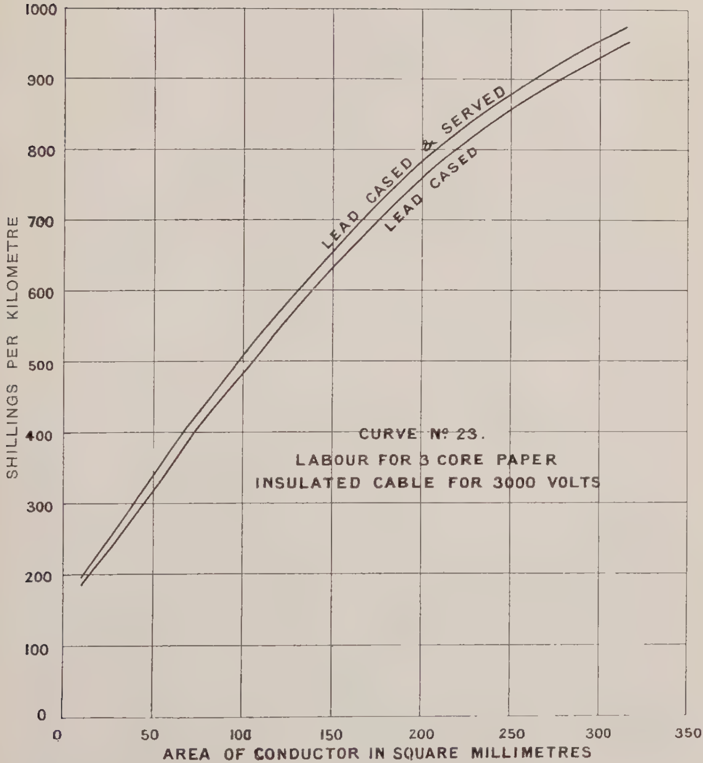

800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
350
SHILLINGS PER KILOMETRE
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD COVERED & STEEL TAPE ARMOURED
LEAD COVERED & SERVED
LEAD COVERED
CURVE Nº 19
LABOUR FOR TWIN CONDUCTOR
PAPER INSULATED CABLE FOR 600 VOLT

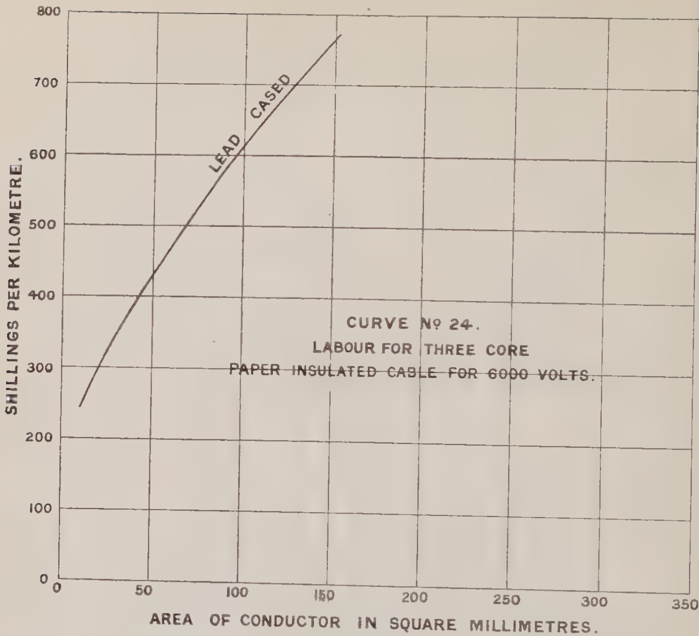

SHILLINGS PER KILOMETRE.
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
350
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD COVERED & STEEL TAPE ARMOUR
LEAD COVERED & SERVED
LEAD COVERED
CURVE Nº 20.
LABOUR FOR THREE CORE PAPER
INSULATED CABLE FOR 600 VOLTS.



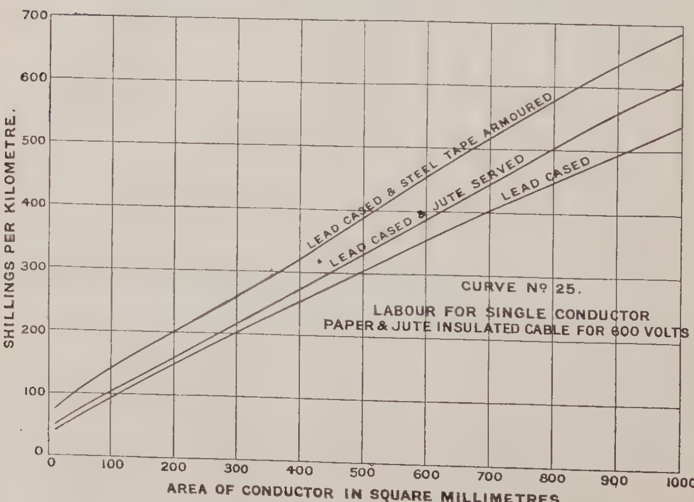
1000
900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE
0
50
100
150
200
250
300
350
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
LEAD COVERED & STEEL TAPE ARMOURED
LEAD COVERED & SERVED
LEAD COVERED
CURVE Nº 21.
LABOUR FOR 3 CORE PAPER
INSULATED CABLE FOR 1000 VOLTS.


LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & SERVED
LEAD CASED
CURVE Nº 22.
LABOUR FOR 3 CORE PAPER
INSULATED CABLE FOR 2000 VOLTS
SHILLINGS PER KILOMETRE
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
0
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
250
300
350

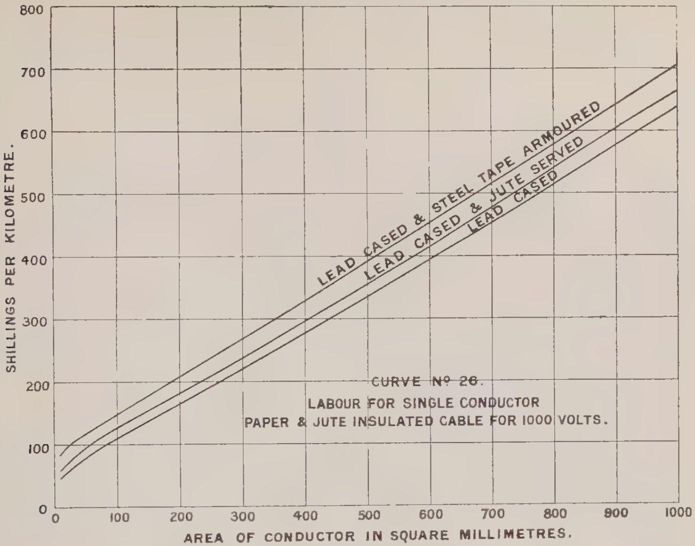

CURVE Nº 23.
LABOUR FOR 3 CORE PAPER
INSULATED CABLE FOR 3000 VOLTS
LEAD CASED & SERVED
LEAD CASED
SHILLINGS PER KILOMETRE
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
0
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
250
300
350

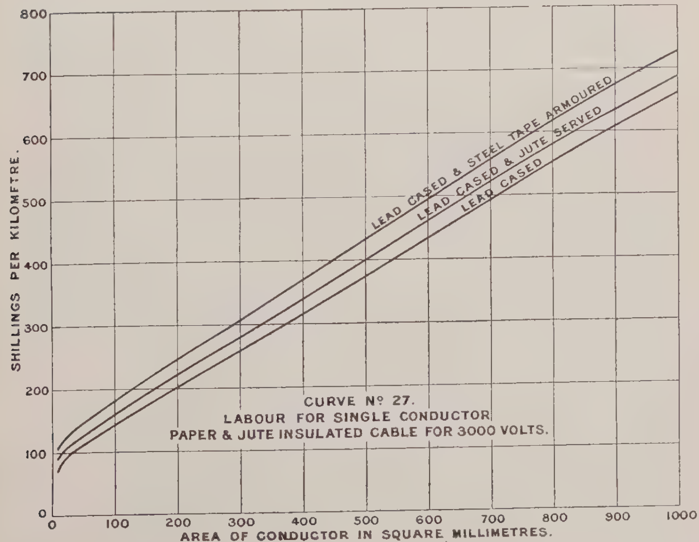


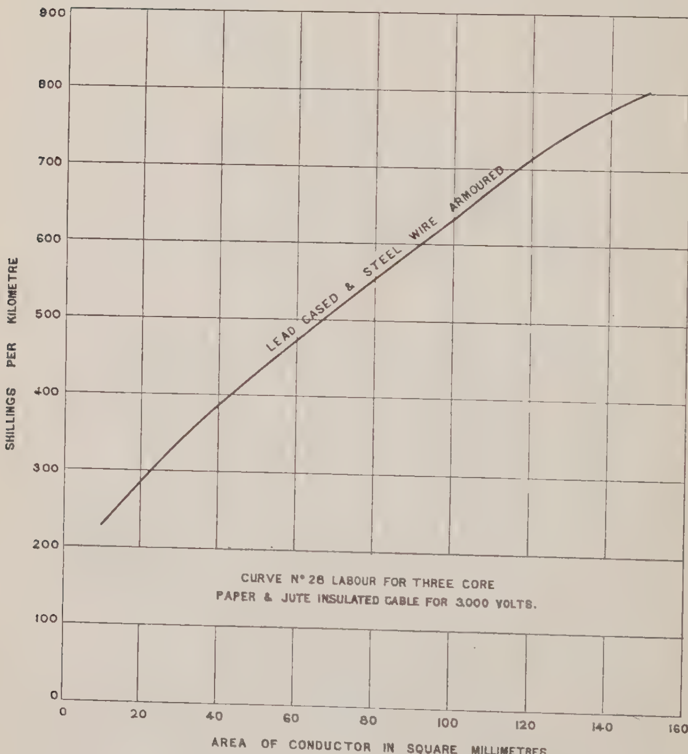
SHILLINGS PER KILOMETRE.
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
350
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED
CURVE Nº 24.
LABOUR FOR THREE CORE
PAPER INSULATED CABLE FOR 6000 VOLTS.



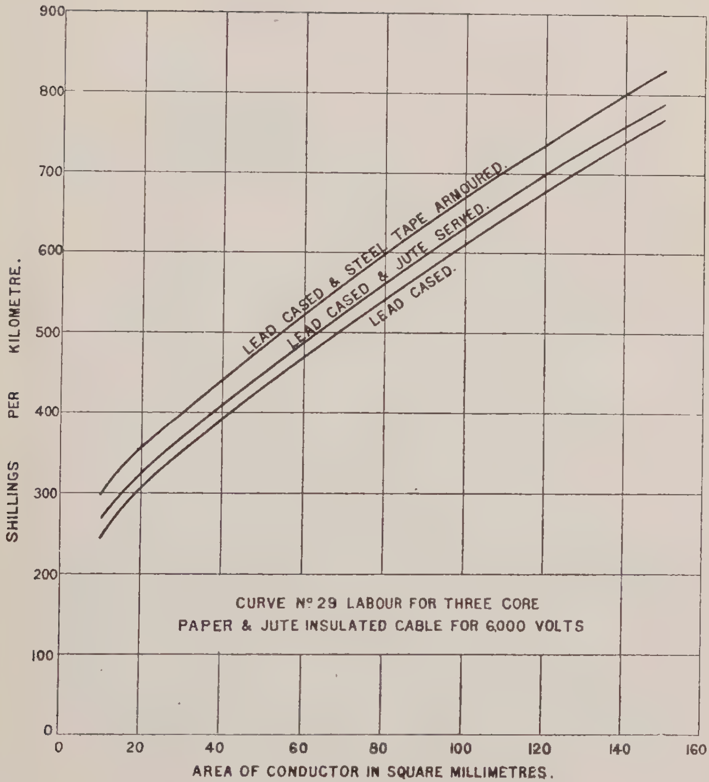
SHILLINGS PER KILOMETRE.
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1000
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 25.
LABOUR FOR SINGLE CONDUCTOR
PAPER & JUTE INSULATED CABLE FOR 600 VOLTS

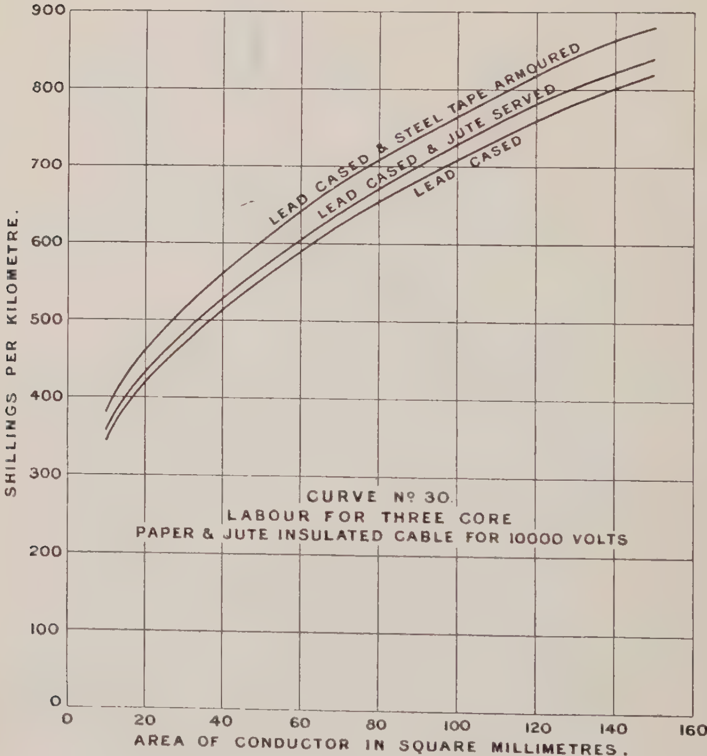

800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE.
0
100
200
300
400
500
600
700
800
900
1000
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 26.
LABOUR FOR SINGLE CONDUCTOR
PAPER & JUTE INSULATED CABLE FOR 1000 VOLTS.

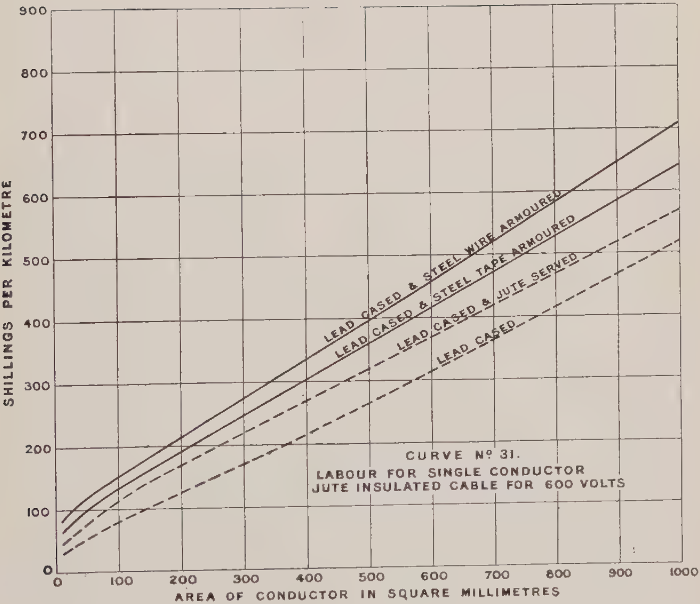

800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE.
0
100
200
300
400
500
600
700
800
900
1000
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 27.
LABOUR FOR SINGLE CONDUCTOR
PAPER & JUTE INSULATED CABLE FOR 3000 VOLTS.



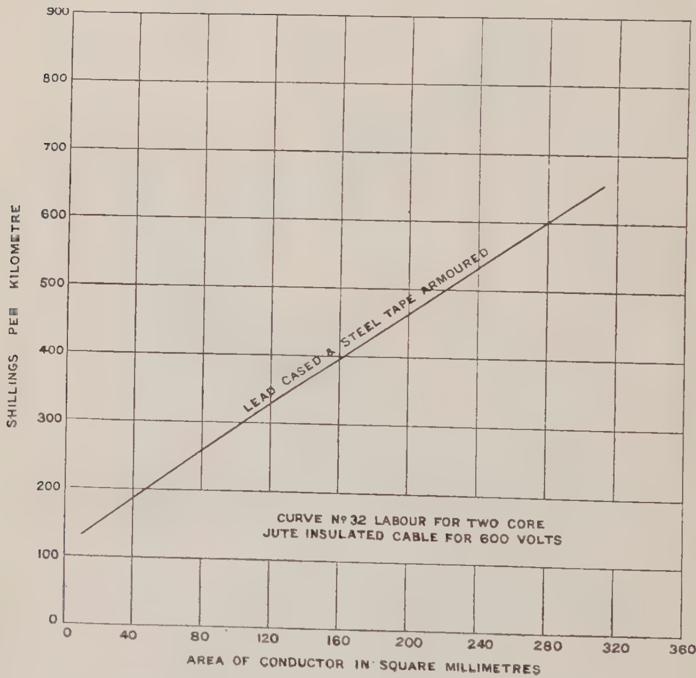
CURVE N° 28 LABOUR FOR THREE CORE PAPER & JUTE INSULATED CABLE FOR 3,000 VOLTS.

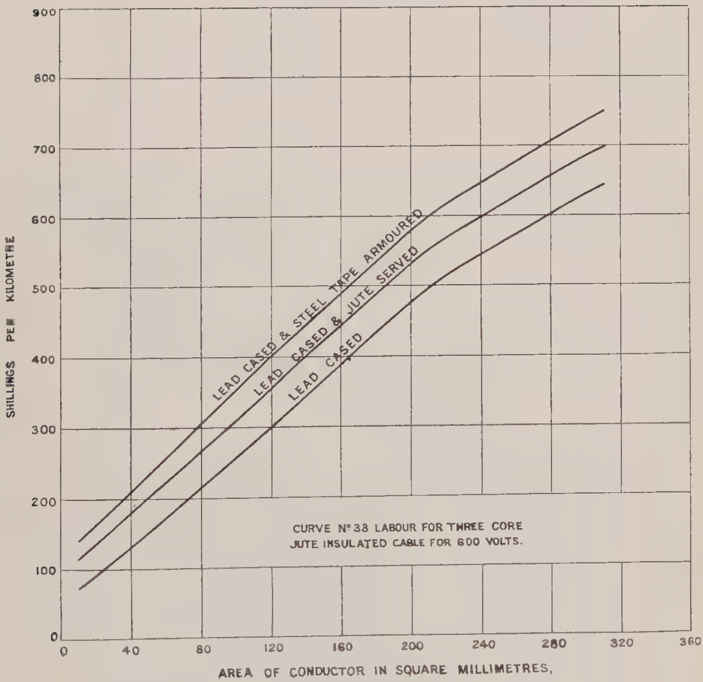

900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE.
0
20
40
60
80
100
120
140
160
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL TAPE ARMOURED.
LEAD CASED & JUTE SERVED.
LEAD CASED.
CURVE Nº 29 LABOUR FOR THREE CORE
PAPER & JUTE INSULATED CABLE FOR 6,000 VOLTS


900
800
700
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
SHILLINGS PER KILOMETRE.
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 30.
LABOUR FOR THREE CORE
PAPER & JUTE INSULATED CABLE FOR 10000 VOLTS

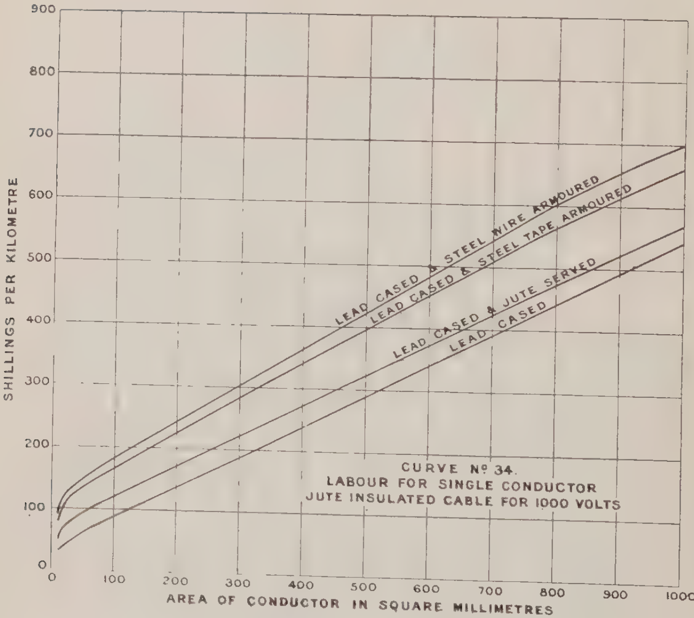


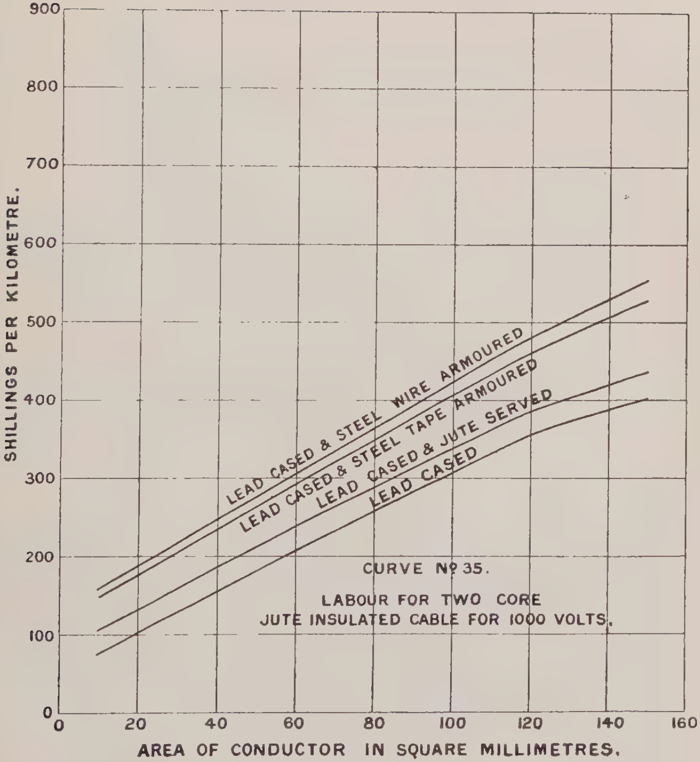
SHILLINGS PER KILOMETRE
900
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1000
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
LEAD CASED & STEEL WIRE ARMOURED
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 31.
LABOUR FOR SINGLE CONDUCTOR
JUTE INSULATED CABLE FOR 600 VOLTS

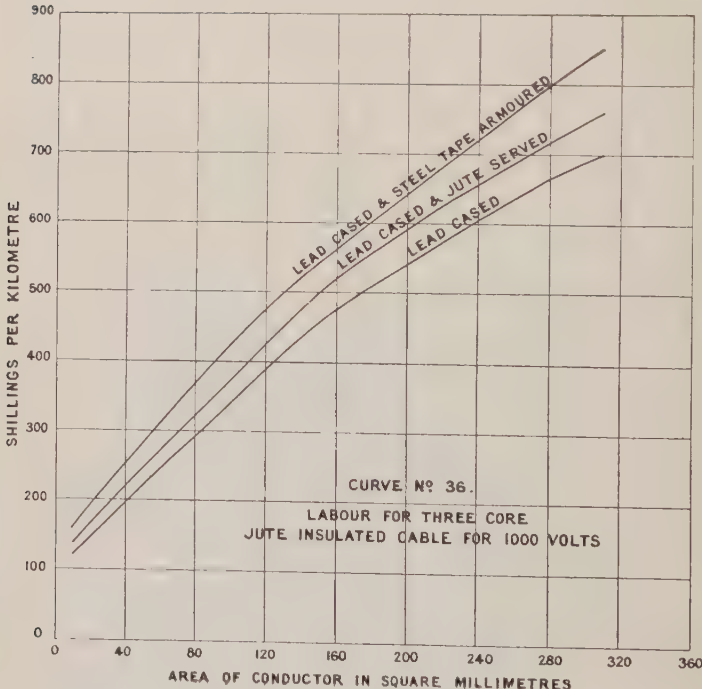

SHILLINGS PER KILOMETRE
900
800
700
600
500
400
300
200
100
0
LEAD CASED & STEEL TAPE ARMOURED
CURVE Nº 32 LABOUR FOR TWO CORE
JUTE INSULATED CABLE FOR 600 VOLTS
0
40
80
120
160
200
240
280
320
360
AREA OF CONDUCTOR IN SQUARE MILLIMETRES

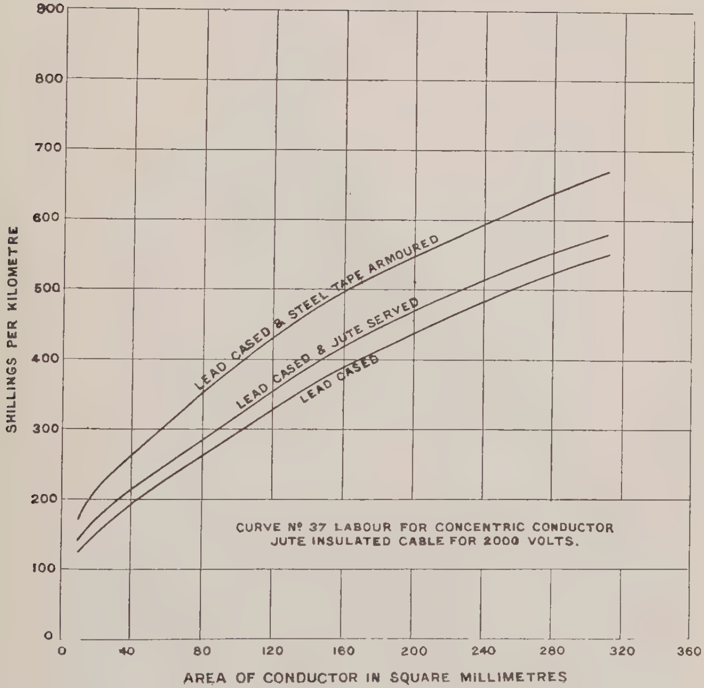


900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE
0
40
80
120
160
200
240
280
320
360
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE N° 38 LABOUR FOR THREE CORE
JUTE INSULATED CABLE FOR 600 VOLTS.

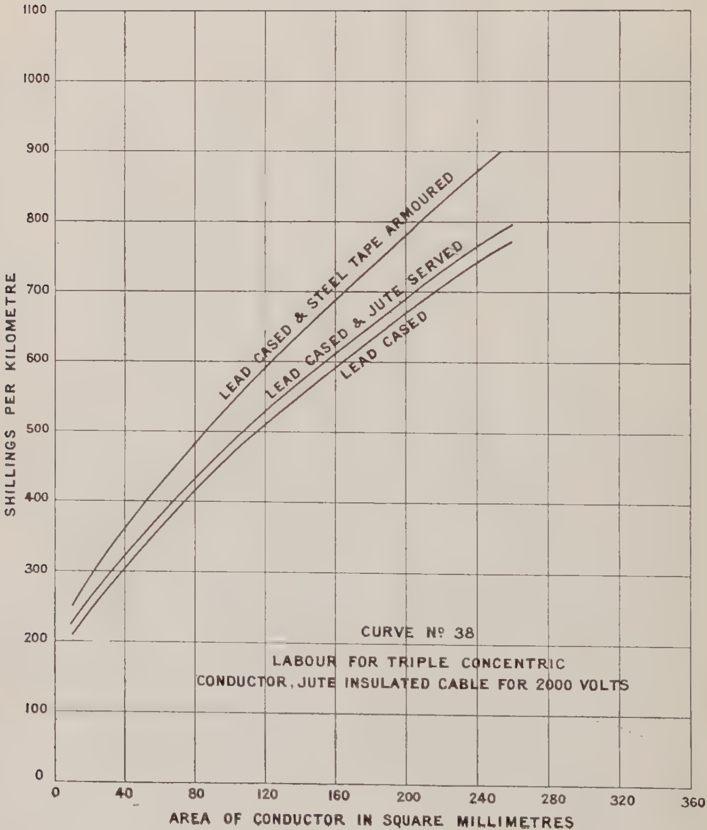

900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE
0
100
200
300
400
500
600
700
800
900
1000
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
LEAD CASED & STEEL WIRE ARMOURED
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 34.
LABOUR FOR SINGLE CONDUCTOR
JUTE INSULATED CABLE FOR 1000 VOLTS

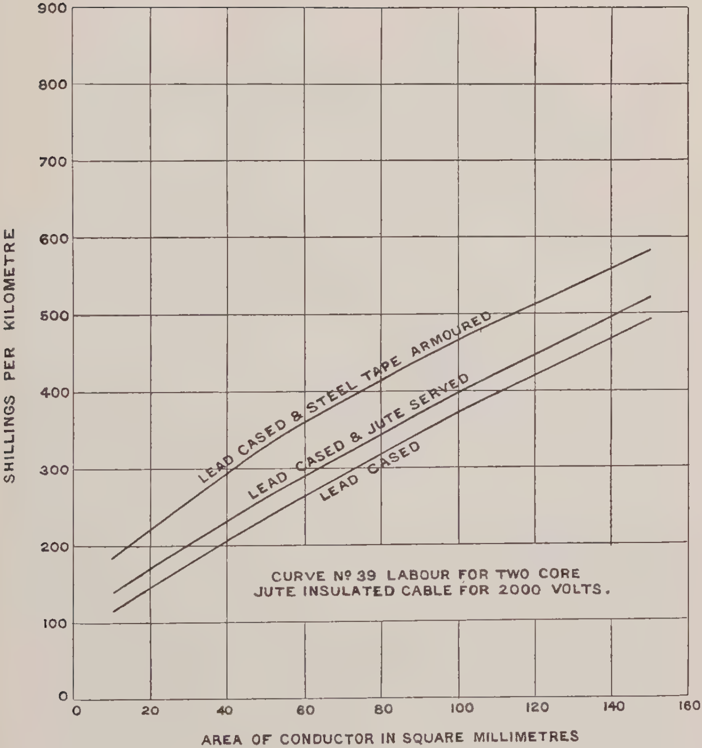

900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE.
0
20
40
60
80
100
120
140
160
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL WIRE ARMOURED
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 35.
LABOUR FOR TWO CORE
JUTE INSULATED CABLE FOR 1000 VOLTS.

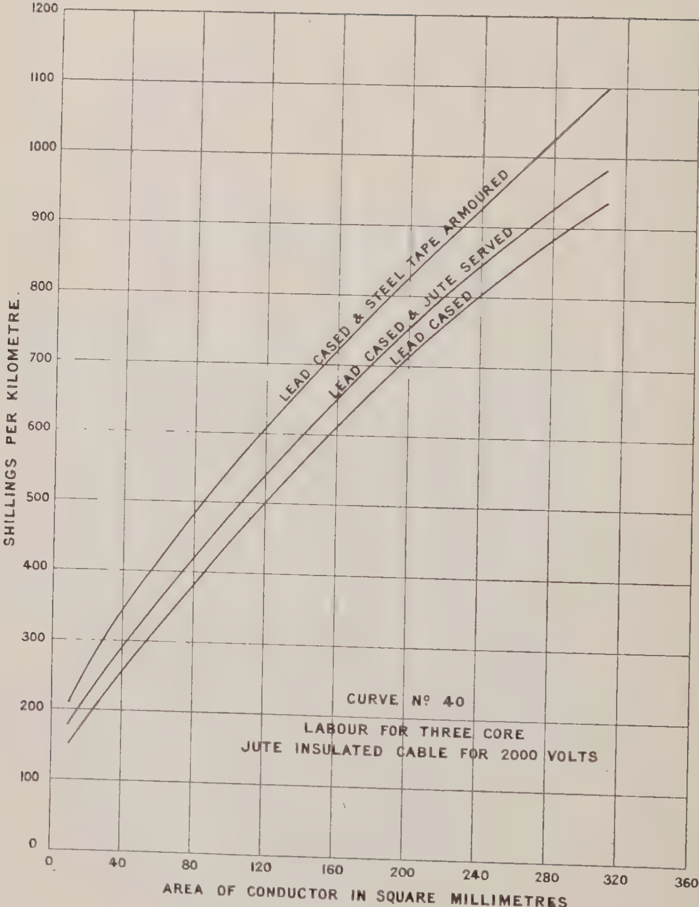

900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE
0
40
80
120
160
200
240
280
320
360
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 36.
LABOUR FOR THREE CORE
JUTE INSULATED CABLE FOR 1000 VOLTS



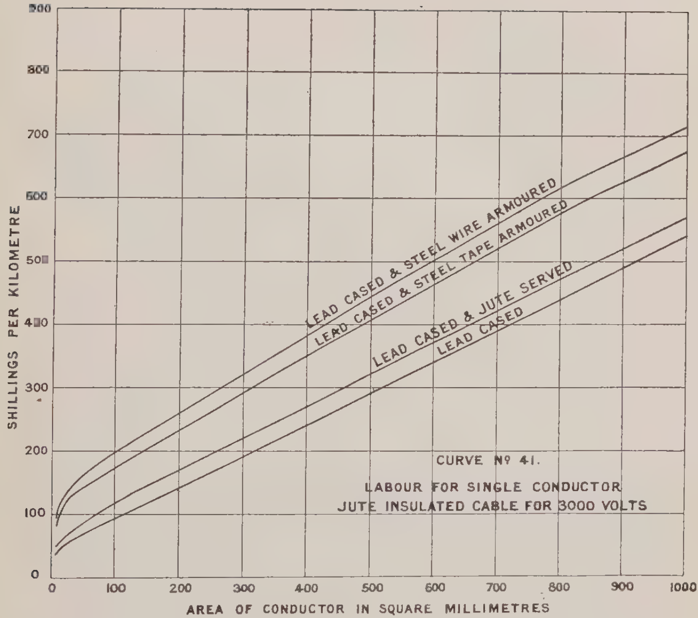
SHILLINGS PER KILOMETRE
900
800
700
600
500
400
300
200
100
0
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 37 LABOUR FOR CONCENTRIC CONDUCTOR
JUTE INSULATED CABLE FOR 2000 VOLTS.
0
40
80
120
160
200
240
280
320
360
AREA OF CONDUCTOR IN SQUARE MILLIMETRES

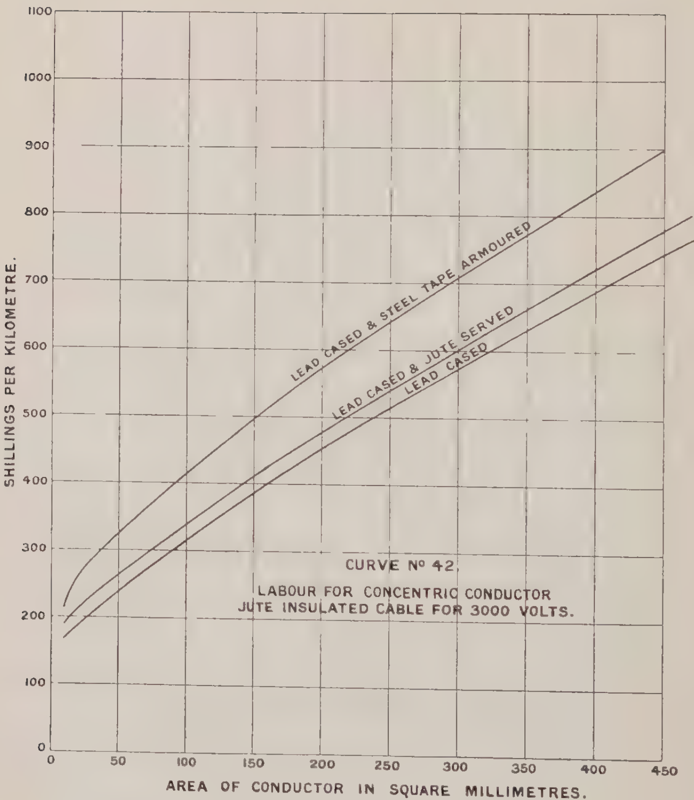

1100
1000
900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE
0
40
80
120
160
200
240
280
320
360
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 38
LABOUR FOR TRIPLE CONCENTRIC
CONDUCTOR, JUTE INSULATED CABLE FOR 2000 VOLTS

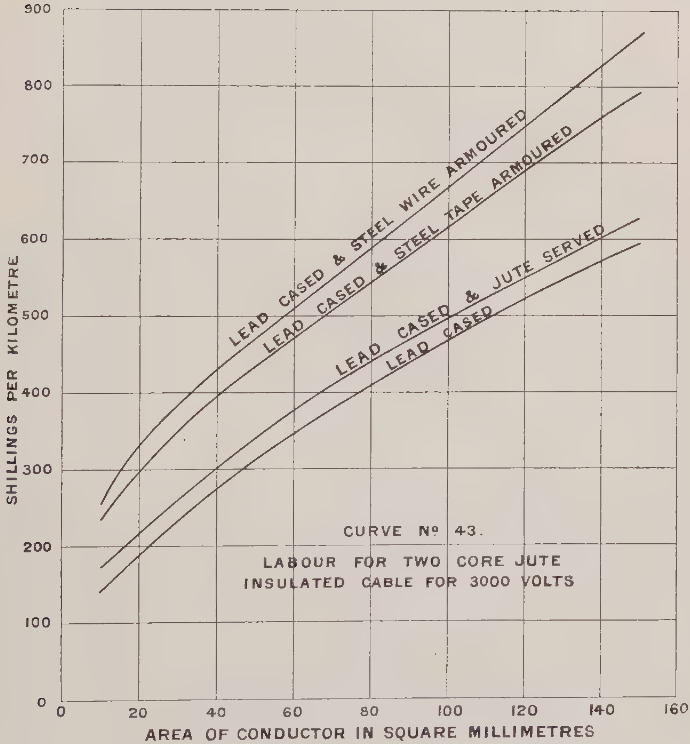

SHILLINGS PER KILOMETRE
900
800
700
600
500
400
300
200
100
0
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 39 LABOUR FOR TWO CORE
JUTE INSULATED CABLE FOR 2000 VOLTS.
0
20
40
60
80
100
120
140
160
AREA OF CONDUCTOR IN SQUARE MILLIMETRES



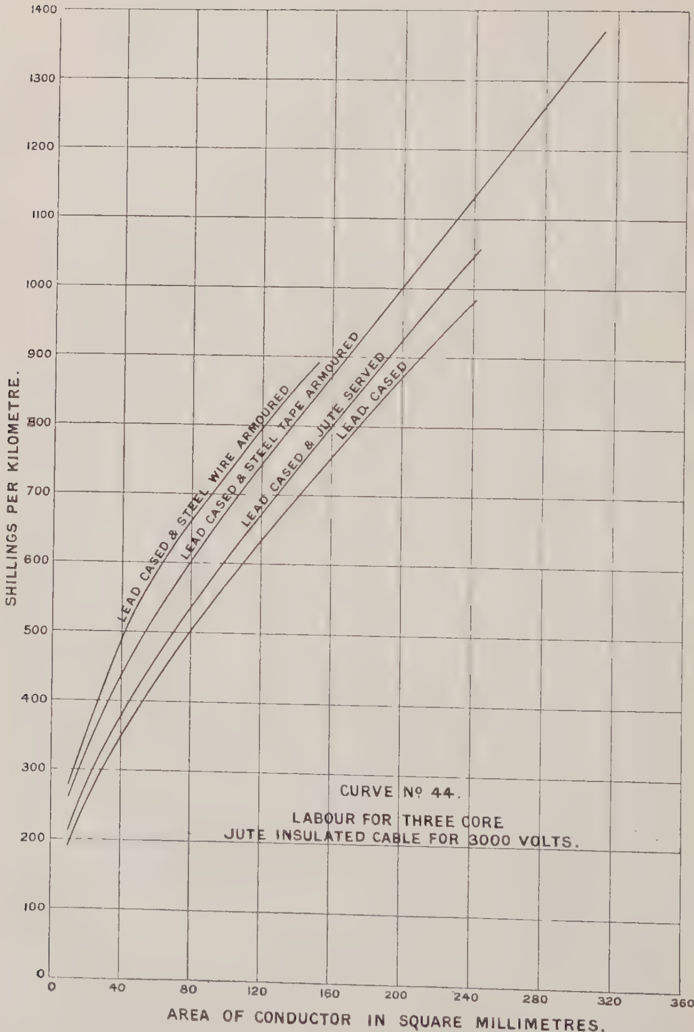
SHILLINGS PER KILOMETRE.
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
40
80
120
160
200
240
280
320
360
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 40
LABOUR FOR THREE CORE
JUTE INSULATED CABLE FOR 2000 VOLTS

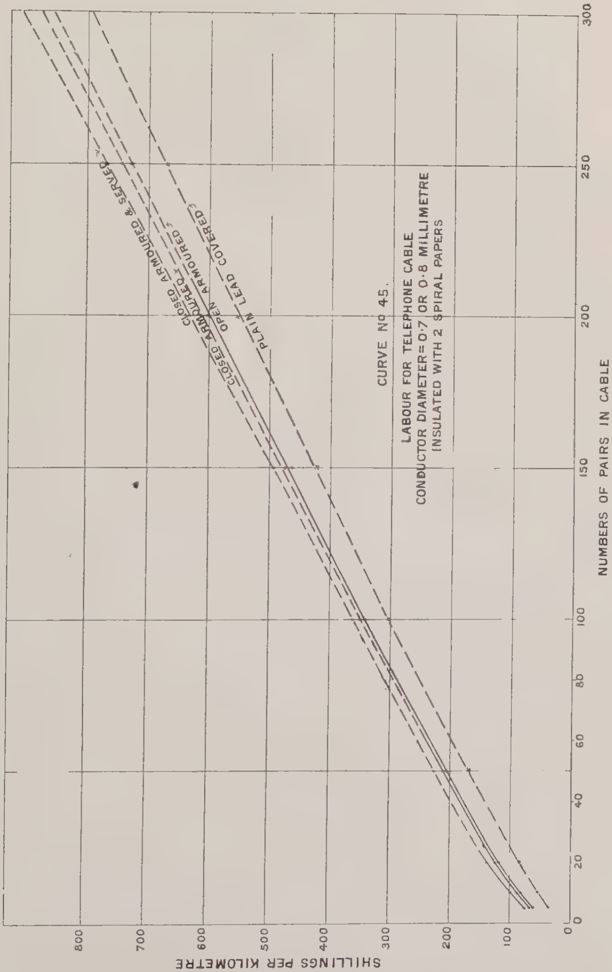

900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE
0
100
200
300
400
500
600
700
800
900
1000
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
LEAD CASED & STEEL WIRE ARMOURED
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 41.
LABOUR FOR SINGLE CONDUCTOR
JUTE INSULATED CABLE FOR 3000 VOLTS

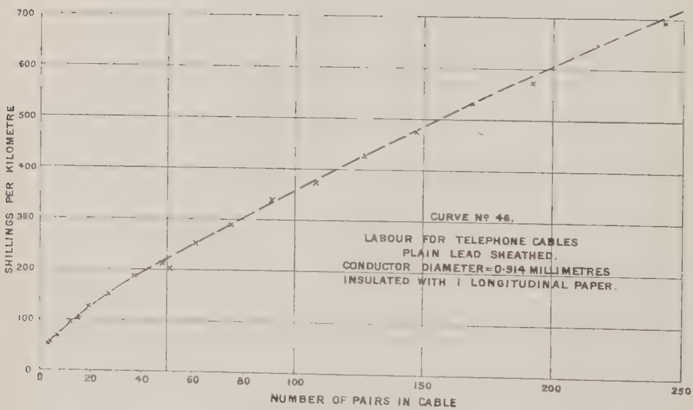

1100
1000
900
800
700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE.
0
50
100
150
200
250
300
350
400
450
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE No 42.
LABOUR FOR CONCENTRIC CONDUCTOR
JUTE INSULATED CABLE FOR 3000 VOLTS.

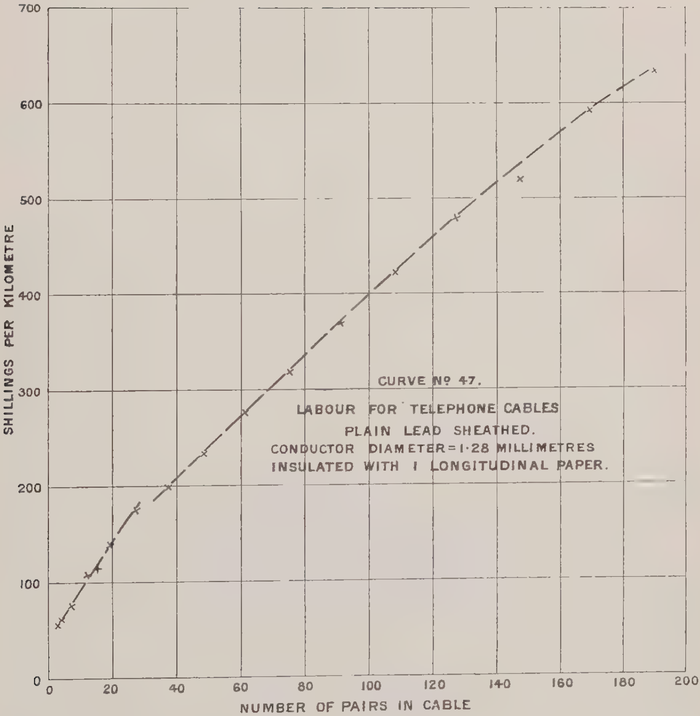


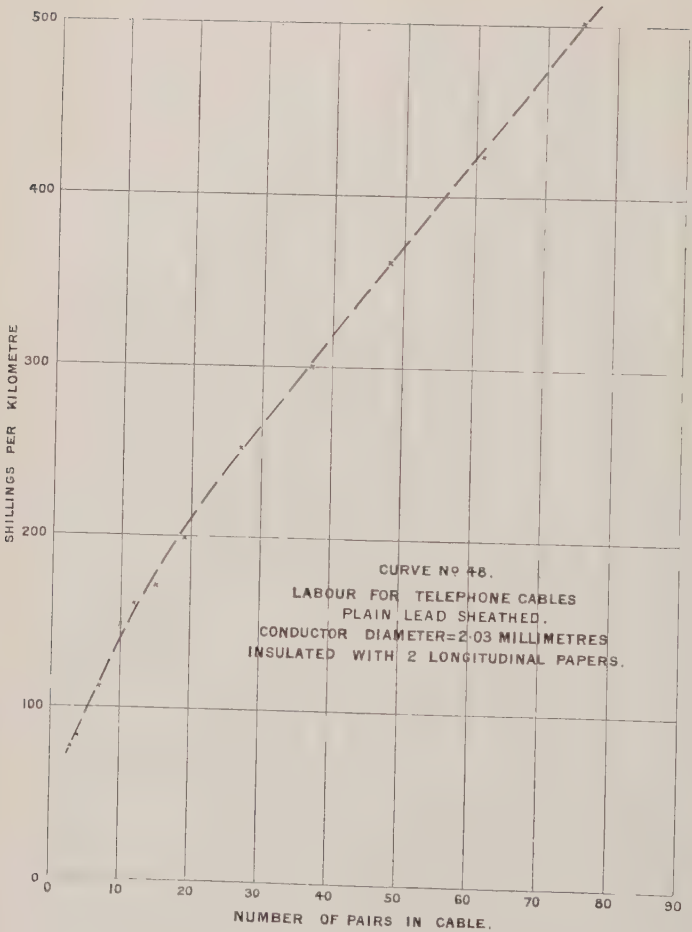
LEAD CASED & STEEL WIRE ARMOURED
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 43.
LABOUR FOR TWO CORE JUTE INSULATED CABLE FOR 3000 VOLTS
SHILLINGS PER KILOMETRE
0
100
200
300
400
500
600
700
800
900
0
20
40
60
80
100
120
140
160
AREA OF CONDUCTOR IN SQUARE MILLIMETRES

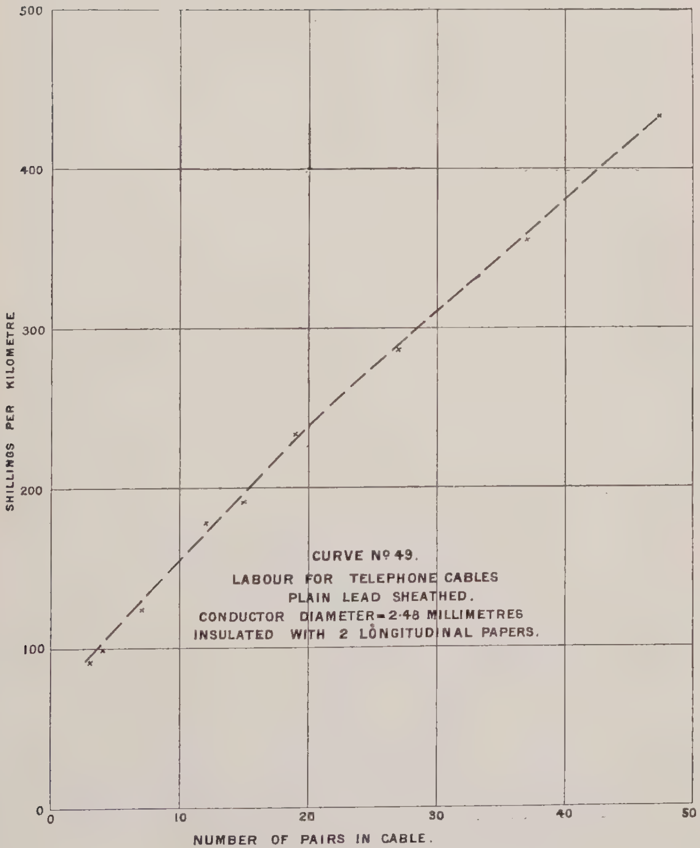

SHILLINGS PER KILOMETRE.
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
40
80
120
160
200
240
280
320
360
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
LEAD CASED & STEEL WIRE ARMOURED
LEAD CASED & STEEL TAPE ARMOURED
LEAD CASED & JUTE SERVED
LEAD CASED
CURVE Nº 44.
LABOUR FOR THREE CORE
JUTE INSULATED CABLE FOR 3000 VOLTS.

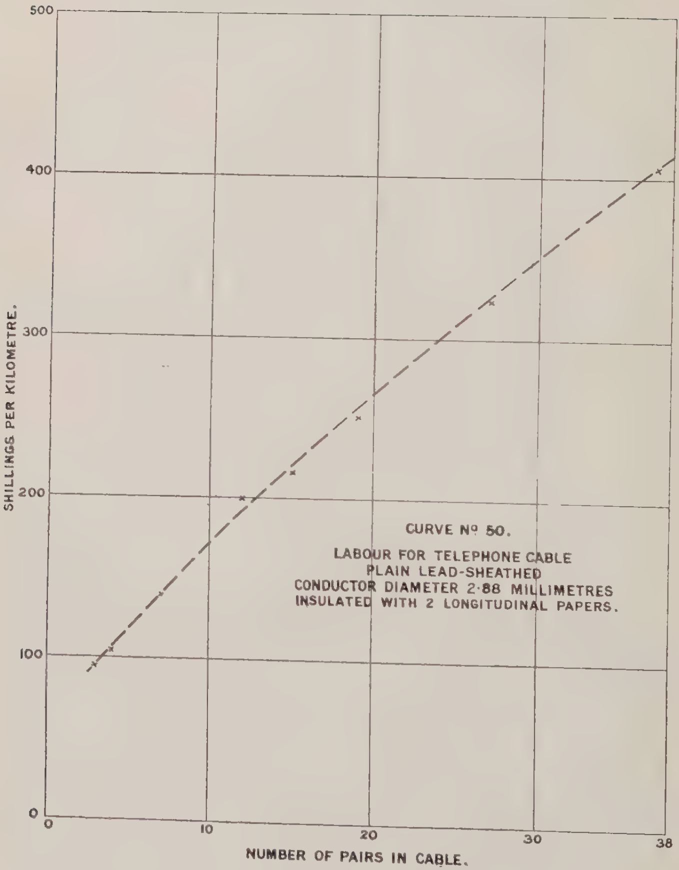

CURVE Nº 45.
LABOUR FOR TELEPHONE CABLE
CONDUCTOR DIAMETER = 0·7 OR 0·8 MILLIMETRE
INSULATED WITH 2 SPIRAL PAPERS
CLOSED ARMOURED & SERVED
CLOSED ARMOURED
OPEN ARMOURED
PLAIN LEAD COVERED
NUMBERS OF PAIRS IN CABLE
0 20 40 60 80 100 150 200 250 300
SHILLINGS PER KILOMETRE
0 100 200 300 400 500 600 700 800


700
600
500
400
300
200
100
0
SHILLINGS PER KILOMETRE
0
20
40
60
80
100
150
200
250
NUMBER OF PAIRS IN CABLE
CURVE Nº 46.
LABOUR FOR TELEPHONE CABLES
PLAIN LEAD SHEATHED.
CONDUCTOR DIAMETER = 0·914 MILLIMETRES
INSULATED WITH 1 LONGITUDINAL PAPER.


CURVE Nº 47.
LABOUR FOR TELEPHONE CABLES
PLAIN LEAD SHEATHED.
CONDUCTOR DIAMETER = 1·28 MILLIMETRES
INSULATED WITH 1 LONGITUDINAL PAPER.
SHILLINGS PER KILOMETRE
NUMBER OF PAIRS IN CABLE
0
100
200
300
400
500
600
700
20
40
60
80
100
120
140
160
180
200


500
400
300
200
100
0
SHILLINGS PER KILOMETRE
CURVE Nº 48.
LABOUR FOR TELEPHONE CABLES
PLAIN LEAD SHEATHED.
CONDUCTOR DIAMETER=2·03 MILLIMETRES
INSULATED WITH 2 LONGITUDINAL PAPERS.
0
10
20
30
40
50
60
70
80
90
NUMBER OF PAIRS IN CABLE.


CURVE Nº 49.
LABOUR FOR TELEPHONE CABLES
PLAIN LEAD SHEATHED.
CONDUCTOR DIAMETER = 2·48 MILLIMETRES
INSULATED WITH 2 LONGITUDINAL PAPERS.
SHILLINGS PER KILOMETRE
NUMBER OF PAIRS IN CABLE.
0
100
200
300
400
500
10
20
30
40
50


500
400
300
200
100
0
SHILLINGS PER KILOMETRE.
0
10
20
30
38
NUMBER OF PAIRS IN CABLE.
CURVE Nº 50.
LABOUR FOR TELEPHONE CABLE
PLAIN LEAD-SHEATHED
CONDUCTOR DIAMETER 2·88 MILLIMETRES
INSULATED WITH 2 LONGITUDINAL PAPERS.

(2) *Waste of Material.*—The waste of material is generally allowed for by an addition of $2\frac{1}{2}$ per cent. of the cost of material in the case of all cables excepting paper and air space telephone cables, and sometimes rubber insulated cables, for which a waste of 5 per cent. is allowed.

(3) *Shop Expenses.*—The shop expenses include rents, rates, taxes, water, heating, lighting, cleaning, and offices, or salaries of unproductive labour. The shop expenses are usually taken as a percentage on the cost of the labour, and vary between 100 per cent. and 200 per cent. Table No. 132 gives the percentages usually charged. The conductor cross section taken is the total; thus, for a 3-core cable of 50 square mm. section conductor, the total cross section is $3 \times 50 = 150$ square mm.

TABLE No. 132.—SHOP EXPENSES.

Type of Cable	Percentage of Labour
Paper or jute insulated: total conductor section up to 50 mm.^{2}	100 per cent.
" " " " " " 51–150 mm.^{2}	150 "
" " " " " " 151–500 mm.^{2}	175 "
" " " " " " above 500 mm.^{2}	200 "
Paper and air space telephone cable	125 "
Rubber insulated cable	100 "

The shop expenses can also be charged as a percentage on the cost of material and labour, and should be approximately 7 per cent. in general cases. For example:—

Let cost of material =	1000	shillings.
and cost of labour =	100	"
	1100	"
Shop expenses at 7 per cent. =	77	"
Total cost =	1177	"

EXAMPLES IN ESTIMATING.

(A) Paper Cables.

Required: a three-core, paper insulated, lead covered and steel-tape armoured cable for 1000 volts working pressure, each conductor to have a cross section of 0·25 sq. in., thickness of dielectric between copper and copper and copper and lead 2·8 mm.

From Table No. 1:

Weight of copper = 1436 kilog. per kilometre
Strand of copper = 37/2·35 mm.
∴ Diameter of conductor = $7 \times 2{\cdot}35 = 16{\cdot}5$ mm.

Taking the market price of copper as . . .	£60	per ton
Cost of rolling and preliminary drawing . . .	4	"
	£64	"

or approximately 128/– per 100 kilog.

∴ Price of copper = 14·36 × 128 = 1838/–.

Thickness of paper copper to copper = 2·8 mm.

∴ Diameter over insulated core = 16·5 + 2·8 = 19·3 mm.

From Table No. 36:

Weight of paper for diameter 19·3 mm. = 321·8
„ „ „ 16·5 „ = 235·2

∴ Weight of paper per core = 86·6 kilog. per kilometre, or roundly 87 kilog. at 40/– per 100 kilog.

∴ Price of paper = 35/–.

Weight of impregnating compound

= 80 per cent. of paper weight = 70 kilog. per kilometre.

∴ Price of compound at 40/– per 100 kilog.
= 28/– per kilometre.

Therefore weight of insulated core = 1593 kilog. per kilometre
Price „ „ „ = 1901/– per kilometre.

Therefore weight of three insulated cores = 4779 kilog.
Price „ „ „ = 5703/–
Plus 1 per cent. for lay of cores = 4827 kilog. per kilometre
„ „ „ „ = 5760/– per kilometre.

The diameter of the three laid up cores with sector-shaped conductors will be

1·861 × 19·3 = 35·93 mm. (or 36·0).

Therefore diameter over the outer insulating paper
= 36·0 + 2·8 = 38·8 mm.

Weight of paper for 38·8 mm. diameter = 1300·5
„ „ 36·0 mm. „ = 1119·8

∴ Weight of paper over laid up cores = 180·7 kilog. per kilometre.
Price of 181 kilog., at 40/– per 100 kilog. = 72·4/–.
Weight of impregnating compound = 80 per cent. of 181 = 145.
Price, at 40/– per 100 kilog. = 58 /–.

Lead thickness = 3·3 mm.
Therefore diameter over lead = 6·6 + 38·8 = 45·4 mm.

Weight of lead for diameter 45·4 mm. = 18405
„ „ „ 38·8 mm. = 13441

∴ Weight of lead sheath . . . = 4964 kilog. per kilometre
Price, at 24/– per 100 kilog. . . = 1192/– per kilometre

From Steel Tape Table for diameter 45·4 mm.:

Weight of steel tape armour = 3377 kilog. per kilometre
Price of steel tape armour = 654·16/ per kilometre
Diameter of finished cable = 45·4 + 4 + 4·4 + 4 = 57·8 mm.

	Diam. in mm.	Weight in kilog. per km.	Price in shillings per kilometre
Copper, 37/2·35 mm. . . . . . per core	16·5	1436	1838
Paper . . . . ,,	19·3	87	35
Impregnated compound . . . . . ,,	19·3	70	28
Each core	..	1593	1901
Three such cores	..	4779	5703
1 per cent. for lay	36·0	48	57
Paper	38·8	181	72·4
Impregnating compound	38·8	145	58
Lead, 3·3 mm. thick	45·4	4964	1192
Steel tape armour	57·8	3377	654·16
Total diameter . . .	57·8	..	..
Total weight . . .	..	13494	..
Total price of material .	..	..	7736·56
Wages (approximately 10 per cent.)	..	..	773·65
Waste of material $2\frac{1}{2}$ per cent, ...	..	..	193·41
Shop expenses ($3 \times 0{\cdot}25$ sq. in. = 484 sq. mm. = 200 per cent.)	..	..	1547·31
Total price in shillings per kilometre .	..	..	10250·93

(B) Jute Cables.

Required: a concentric conductor, jute insulated lead sheathed and steel wire armoured cable; each conductor of 240 sq. mm. cross section; thickness of inner dielectric 3 mm., and of outer dielectric 2·5 mm.

From Table No. 2: for 240 mm.²—

Weight of copper = 2139 kilog. per kilometre
Strand of copper = 37/2·87 mm.
$\therefore$ Diameter of strand = $7 \times 2{\cdot}87 = 20{\cdot}1$ mm.

Taking market price of copper as . . .	£60 per ton.
Rolling and preliminary drawing . . .	4 ,,
Price of copper . .	£64 ,,

that is approximately 128/– per 100 kilog.

$\therefore$ Cost of copper = $21{\cdot}39 \times 128 = 2738$/– per kilometre.

Diameter over jute = $20{\cdot}1 + 6 = 26{\cdot}1$ mm.

Therefore the weight of jute

$$= 0{\cdot}687\,(D^2 - d^2) = 0{\cdot}687\,(26{\cdot}1^2 - 20{\cdot}1^2)$$
$$= 190 \text{ kilog. per kilometre,}$$

and cost of jute at 44/– per 100 kilog.

$$= 1{\cdot}9 \times 44 = 83{\cdot}6/\text{– per kilometre.}$$

Weight of impregnating compound

$$= 80 \text{ per cent. of } 190 = 152,$$

and price at 26/– per 100 kilog.

$$= 1{\cdot}52 \times 26 = 39{\cdot}5/\text{–}.$$

Outer Conductor.—Diameter of the wires (d)

$$= \tfrac{1}{2}\sqrt{(1{\cdot}625\,Q + D^2)} - \frac{D}{2}$$

$$\therefore\quad d = \tfrac{1}{2}\sqrt{\{1{\cdot}625\,(240) + 26{\cdot}1^2\}} - 13{\cdot}05$$
$$= 3{\cdot}3 \text{ mm.}$$

The number of such wires (N)

$$= \frac{\pi\,(D + d)}{d} = 28 \text{ wires.}$$

The weight and price of the outer conductor will be the same as for the inner conductor.

The diameter over the outer conductor $= 26{\cdot}1 + 6{\cdot}6 = 32{\cdot}7$ mm.

Outer jute insulation $2{\cdot}5$ mm. thick

$\therefore$ Diameter over jute $= 32{\cdot}7 + 5{\cdot}0 = 37{\cdot}7$ mm.

Weight of jute $= 0{\cdot}687\,(37{\cdot}7^2 - 32{\cdot}7^2) = 242$ kilog. per kilometre.

Cost of jute at 44/– per 100 kilog. $= 2{\cdot}42 \times 44 = 106{\cdot}5$/– per. kilometre.

Weight of impregnating compound $= 80$ per cent. of $242 = 194$ kilog.

Cost at 26/– per 100 kilog $= 1{\cdot}94 \times 26 = 50{\cdot}5$/–.

Lead sheath $2{\cdot}6$ mm. thick.

$\therefore$ Diameter over lead $= 37{\cdot}7 + 5{\cdot}2 = 42{\cdot}9$ mm.

Weight of lead for diameter 42·9 mm.	= 16434
” ” ” ” ” 37·7 ”	= 12695
Weight of lead in kilog. per kilometre	= 3739

and cost at 24/– per 100 kilog. $= 37{\cdot}39 \times 24 = 897$/–.

Wire Armour—Diameter over lead . $= 42{\cdot}9$ mm.

Jute serving $1{\cdot}5$ mm. thick $= 45{\cdot}9$ mm.

From Table No. 115: Sheath will be $35 \times 4{\cdot}5$ mm., and Weight $= 4426$ kilog. per kilometre, and Cost at 18/- per 100 kilog. $= 44{\cdot}26 \times 18 = 797$/–.

Pitch diameter of sheath $= 45{\cdot}9 + 4{\cdot}5 = 50{\cdot}4$ mm.

Diameter over sheath $= 45{\cdot}9 + 9{\cdot}0 = 54{\cdot}9$ ”

Jute under wires

$$= 0{\cdot}625\left(50{\cdot}4^2 - 42{\cdot}9^2 - \frac{35}{2} \times 4{\cdot}5^2\right)$$
$$= 216 \text{ kilog. per kilometre}$$

and cost at 35/– per 100 kilog. $= 75{\cdot}6$/–.

Jute over wires = 1 layer 5 lb. jute (thickness $1{\cdot}6$ mm.).

$\therefore$ Diameter over jute $= 54{\cdot}9 + 3{\cdot}2 = 58{\cdot}1$ mm.

Weight of jute

$$= 0 \cdot 3275 \left(58 \cdot 1^2 - 50 \cdot 4^2 - \frac{35}{2} \times 4 \cdot 5^2\right)$$

$$= 158 \text{ kilog. per kilometre}$$

cost at 35/– per 100 kilog. = 55·3/–.

Weight of tar = 80 per cent. of jute weight
= 0·8 (216 + 158) = 300 kilog. per kilometre,

cost at 4·43/– per 100 kilog. = 13·3/–.

Weight of compound = weight of tar
= 300 kilog. per kilometre,

cost at 4·1/– per 100 kilog. = 12·3/–.

	Diam. in mm.	Weight in kilogs. per km.	Price in shillings per kilometre
Copper 37/2·87 mm.	20·1	2139	2738
Jute 3·0 mm.	26·1	190	83·6
Impregnating compound	26·1	152	39·5
Outer copper 28/3·3 mm.	32·7	2139	2738
Jute 2·5 mm.	37·7	242	106·5
Impregnating compound	37·7	194	50·5
Lead 2·6 mm.	42·9	3739	897
Jute 1·5 mm.	45·9	216	75·6
Steel wires 35/4·5 mm.	54·9	4426	797
Jute 1·6 mm.	58·1	158	55·3
Tar	..	300	13·3
Compound	..	300	12·3
			..
Total diameter	58·1	..	..
Total weight	..	14195	
Total cost of material	..	..	7607
Wages (approximately 12 per cent.)	..	..	913
Waste of material $2\frac{1}{2}$ per cent.	..	..	190
Shop expenses (for 2 × 240 sq. mm = 175 per cent.)	..	..	1589
Total price in shillings per kilometre	..	..	10308

(C) Rubber Cable.

Required: 19/20 L.S.W.G. rubber insulated, braided, and compound, 40 per cent. rubber.

Conductor 19/20 = 19/·036 inch = 19/0·914 mm.
Diameter of strand = 5 × 0·914 = 4·57 mm.

From Table No. 14, weight of copper

$$= 247 \cdot 5 \text{ lb. per kilometre,}$$
$$= 112 \cdot 3 \text{ kilog. per kilometre}$$

Taking market price of copper at £60 per ton, plus, for rolling and preliminary drawing, £4.

∴ Price of 1·4 mm. diameter plain wire = £64 per ton, or approximately 128/– per 100 kilog.

Cost of drawing to 0·914 mm. diameter = 2·5/– per 100 kilog.
Cost of double tinning = 10/– per 100 kilog.
∴ Price of wire = 140·5/– per 100 kilog.
∴ Price of 19/20 = 157·7/– per kilometre.

Pure Rubber (say 0·2 mm. thick).

From Table No. 63:

$$\text{Weight} = 0 \cdot 637\, d + 0 \cdot 129 = 3 \cdot 04 \text{ kilog. per kilometre.}$$

If the market price of Para rubber be 6/– per lb., the price of cleaned Para will be (from Table No. 64) 15·94/– per kilog.

∴ Cost of pure rubber = 3·04 × 15·94 = 48·45/– per kilometre.

Compound Rubber.—Taking total thickness of rubber as 1·3 mm.

Diameter of strand = 4·6 mm.	∴ Area =	16·619 mm.^{2}
Then the reduced area = 0·85 (16·619)	=	14·126
Diameter over rubber = 7·2 mm.	∴ Area =	40·715
∴	Total rubber section =	26·589
Pure rubber section (specific gravity = 1·0)	=	3·04
∴	Compound rubber section =	23·549 mm.^{2}

Therefore the weight of compound rubber will be (specific gravity = 1·6) —

$$23 \cdot 549 \times 1 \cdot 6 = 37 \cdot 7 \text{ kilog. per kilometre.}$$

Taking raw Para at 6/– per lb., then the price of 40 per cent. compound rubber (Table No. 66) will be approximately 2/6½ per lb.

∴ Cost of compound rubber = 211·25/– per kilometre.

Tape.—Weight of tape = 0·8 d = 0·8 (7·2 + 0·3)
= 6·0 kilog. per kilometre.

Cost of tape at 3·5/– per kilog. = 21/– per kilometre.
Diameter over tape = 7·2 + 0·6 = 7·8 mm.

Braid.—8/2 cotton: increase of diameter = 1·4 mm.

∴ Diameter over braid = 7·8 + 1·4 = 9·2 mm.
Weight of cotton = $0 \cdot 432\,(9 \cdot 2^2 - 7 \cdot 8^2) = 10 \cdot 2$ kilog.
Cost at 60/– per 100 lb. = 13·5/– per kilometre.

Compound.—At 130 per cent. of cotton weight.

Weight = 1·3 × 10·2 = 13·26 kilog. per kilometre, and cost at 61·7/– per 100 kilog. = 8·2/– per kilometre.

	Diameter in mm.	Weight in kilog. per km.	Cost in shillings per km.
Copper 19/20 L.S.W.G.	4·57	112·3	157·7
Pure 0·2 mm.	..	3·04	48·45
Compound rubber 40 per cent.	7·2	37·7	211·25
Tape	7·8	6·0	21·0
Braid 8/2 cotton	9·2	10·2	13·5
Compound	..	13·26	8·2
Total weight	..	182·5	..
Total cost of material	..	..	460·1
Wages (10 per cent.)	..	..	46·0
Waste of material $2\frac{1}{2}$ per cent.	..	..	11·5
Shop expenses (100 per cent. of wages)	..	..	46·0
Total price in shillings per kilometre	..	..	563·6

(D) Paper and Air Space Telephone Cable.

Required: 600 pair 0·5 mm. conductor, lead sheathed, telephone cable, each conductor insulated with one longitudinal paper; wire to wire capacity, 0·04 microfarads per kilometre.

From Table No. 81: $Kx = 2\cdot42$.

∴ Equivalent diameter of core (b) is given by:—

$$\text{Log}_{10}\frac{b}{r} = \frac{0\cdot01208 \times 2\cdot42}{0\cdot040} = 0\cdot73 \text{ mm.}$$

$$\therefore \quad \text{Log}_{10} b - \log_{10} 0\cdot25 = 0\cdot73.$$

$$\therefore \quad b = 1\cdot35 \text{ mm.}$$

∴ Diameter of insulated pair will be

$$1\cdot35\sqrt{2} = 1\cdot91 \text{ mm.}$$

Diameter coefficient given in Table No. 79 = 28·155.

Therefore diameter over laid-up pairs

= 28·155 × 1·91 = 53·7 mm.
1 layer of paper over pairs = 54·2 mm.
1 layer of cotton tape over pairs = 54·7 ,,

Lead 3·0 mm. thick to diameter 60·7 mm.

Copper.—0·5 mm. diameter weighs 1·75 kilog. per kilometre.

Taking market price of copper at	£60 per ton.
Plus rolling and preliminary drawing	4 ,,
	£64

Or, approximately . . 128/– per 100 kilog.
Extra for drawing to 0·5 mm. 4/– " "
Extra for tinning . . 11/– " "

Therefore price of plain wire = 132/– per 100 kilog.
" " tinned " = 143/– " "

Paper.—Width = πb + 10 per cent. = $\pi(1{\cdot}35 \times 1{\cdot}1) = 4{\cdot}66$, or 5 mm. paper, taking paper 0·07 mm. thick the weight will be $5 \times 0{\cdot}07 = 0{\cdot}35$ kilog. per kilometre.

Paper over laid up pairs.—
Weight = diameter × 0·6 = 53·7 × 0·6 = 32 kilog. per kilometre.
Cost, at 40/– per 100 kilog. = 13/– per kilometre.

Cotton Tape under lead.—
Weight = diameter × 0·8 = 54·2 × 0·8 = 44 kilog. per kilometre.
Cost, at 200/– per 100 kilog. = 88/– per kilometre.

Lead.— Weight for diameter 60·7 mm. = 32903
" " 54·7 mm. = 26720

Therefore weight of lead sheath . . . = 6183 kilog. per kilometre.
Cost at 24/– per 100 kilog. = 1484/– per kilometre.

	Price per 100 kilog.	Weight in kilog. per km.	Cost in Shillings per km
{1 km., 0·5 mm. plain copper	132/–	1·75	2·31
{1 longitudinal paper	80/–	0·35	0·28
{1 km, 0·5 mm. tinned copper	143/–	1·75	2·50
{1 longitudinal paper	80/–	0·35	0·28
1 km. of insulated pair	..	4·20	5·37
Plus 1 per cent. for lay	..	0·04	0·05
Cost of pair	..	4·24	5·42
600 such pairs	..	2544	3252
2 per cent. for lay	..	51	65
1 layer of paper	..	32	13
1 layer of cotton tape	..	44	88
Lead sheath	..	6183	1484
Total weight per kilometre	..	8854	..
Total cost of material	..	..	4902
Wages (approximately 12 per cent.)	..	..	588
Waste of material 5 per cent.	..	..	243
Shop expenses (125 per cent. of wages)	..	..	735
Total price in shillings per kilometre	..	..	6468

CHAPTER XII.

COMPLETE CABLES.

THE following tables give the constructional data of various series of cable, insulated with paper, paper and jute, jute, india-rubber, and paper and air space.

The larger sizes of cable in Table No. 152 will not be very economical when used for alternating current, on account of the increased resistance due to skin effect; if single conductor cable of large conductor cross-section is required for the transmission of alternating current, it will be more economical to construct a rope stranded conductor, each unit or alternate unit being lapped with a layer of paper in order to reduce the eddy currents in the conductor.

The over-all diameter of the larger sizes in Tables Nos. 153–4–6–7–8 may be reduced by using segmental copper strips to form the concentric conductors instead of the circular wires as shown.

TABLE No. 133.—CONSTRUCTIONAL DATA FOR SINGLE CONDUCTOR, PAPER INSULATED, ARMOURED CABLE WITH TEST WIRE. Thickness of Paper Insulation = 1·5 mm. (= 59 mils). (For 600 volts working pressure.)

Sectional Area of Conductor, sq.mm.	Details of Strand		Diameter in mm. over					Thickness of Lead Sheath, mm.	Dimensions of Steel Tape Armour, mm.	Total Weight of Cable, kilog. per km.
	No. of Wires	Diam. of Wire, mm.	Copper	Paper	Lead	Steel Tape Armour	Outside Serving			
10	3	2·06	5·0	8·0	11·0	18·6	22·6	1·5	20×0·8	1150
16	3	2·6	6·3	9·3	12·3	19·9	23·9	1·5	20×0·8	1560
25	6	2·3	6·9	9·9	12·9	20·1	24·1	1·5	20×0·8	1700
35	6	2·72	8·2	11·2	14·2	21·4	25·4	1·5	20×0·8	1920
50	6	3·26	9·8	12·8	15·9	23·1	27·1	1·55	20×0·8	2270
70	6	3·85	11·6	14·6	17·8	25·4	29·4	1·6	25×0·9	2780
95	18	2·59	13·0	16·0	19·3	26·9	30·9	1·65	25×0·9	3240
120	18	2·91	14·6	17·6	21·1	28·7	32·7	1·75	25×0·9	3720
150	18	3·26	16·3	19·3	23·0	30·6	34·6	1·85	25×0·9	4310
185	18	3·62	18·1	21·1	25·0	32·6	36·6	1·95	33×0·9	4950
210	18	3·86	19·3	22·3	26·3	33·9	37·9	2·0	33×0·9	5390
240	18	4·12	20·6	23·6	27·7	35·3	39·3	2·05	33×0·9	5890
280	36	3·15	22·1	25·1	29·3	36·9	40·9	2·1	33×0·9	6500
310	36	3·31	23·2	26·2	30·5	38·1	42·1	2·15	33×0·9	7000
355	36	3·55	24·9	27·9	32·3	40·3	44·3	2·2	43×1·0	7680
400	36	3·76	26·3	29·3	33·8	41·8	45·8	2·25	43×1·0	8520
500	36	4·21	29·5	32·5	37·2	45·2	49·2	2·35	43×1·0	10010
625	60	3·65	32·9	35·9	40·9	48·9	52·9	2·5	43×1·0	11850
725	60	3·92	35·6	38·6	43·8	52·2	56·2	2·6	55×1·1	13360
800	60	4·12	37·1	40·1	45·4	53·8	57·8	2·65	55×1·1	14390
1000	90	3·76	41·4	44·4	50·0	58·4	62·4	2·8	55×1·1	17140

TABLE No. 134.—DIAMETER AND WEIGHT OF LEAD-COVERED SINGLE CABLE. Insulated with 2 mm. thickness of paper (= 79 mils).

Section of Conductor		Strand of Copper Wires	Thickness of Lead $\frac{D}{20} \times 0 \cdot 9$	Diameter in mm. over			Weight in kilog. per km.			
sq. in.	sq. mm.			Conductor	Paper	Lead	Copper	Paper	Impregnating Compound	Lead
0·050	32·25	19×1·47	1·5	7·4	11·4	14·4	287	65	52	691
·100	64·5	19×2·08	1·6	10·4	14·4	17·6	575	86	69	914
·125	80·6	19×2·34	1·7	11·7	15·7	19·1	719	95	76	1057
·150	96·7	37×1·83	1·75	12·8	16·8	20·3	862	102	82	1160
·20	129	37×2·08	1·85	14·6	18·6	22·3	1150	115	92	1352
·25	161	37×2·34	1·9	16·4	20·4	24·2	1437	127	102	1513
·30	193	37×2·57	2·0	18·0	22·0	26·0	1724	138	110	1715
·35	226	37×2·79	2·1	19·5	23·5	27·7	2012	149	119	1871
·40	258	61×2·34	2·15	21·1	25·1	29·4	2300	160	128	2085
·50	322	61×2·57	2·25	23·1	27·1	31·6	2874	173	138	2303
·60	387	91×2·34	2·4	25·7	29·7	34·5	3449	191	153	2640
·70	452	91×2·49	2·45	27·4	31·4	36·3	4025	203	162	3028
·75	484	91×2·57	2·5	28·3	32·3	37·3	4311	209	167	3107
·80	516	91×2·64	2·55	29·0	33·0	38·1	4599	214	171	3238
·90	581	91×2·79	2·65	30·7	34·7	40·0	5173	226	181	3535
1·0	645	127×2·57	2·75	33·4	37·4	42·9	5748	245	196	3944

TABLE No. 135.—CONSTRUCTIONAL DATA FOR SINGLE CONDUCTOR, PAPER INSULATED, ARMOURED CABLE WITH TEST WIRE. For 1000 volts working pressure. Thickness of Paper Insulation = 2 mm. (= 79 mils).

Sectional Area of Conductor, sq. mm.	Details of Strand		Diameter in mm. over					Thickness of Lead Sheath, mm.	Dimensions of Steel Tape, mm.	Total Weight of Cable, kilog. per km.
	Number of Wires	Diam. of Wire, mm.	Copper	Paper	Lead	Steel Tape	Outer Serving			
10	3	2·06	5·0	9·0	12·0	19·2	23·2	1·5	20×0·8	1260
16	3	2·6	6·3	10·3	13·3	20·5	24·5	1·5	20×0·8	1450
25	6	2·3	6·9	10·9	13·9	21·1	25·1	1·5	20×0·8	1580
35	6	2·72	8·2	12·2	15·3	22·5	26·5	1·55	20×0·8	2100
50	6	3·26	9·8	13·8	17·0	24·6	28·6	1·6	25×0·9	2550
70	6	3·85	11·6	15·6	18·9	26·5	30·5	1·65	25×0·9	2980
95	18	2·59	13·0	17·0	20·4	28·0	32·0	1·7	25×0·9	3440
120	18	2·91	14·6	18·6	22·2	29·8	33·8	1·8	25×0·9	3940
150	18	3·26	16·3	20·3	24·1	31·7	35·7	1·9	33×0·9	4550
185	18	3·62	18·1	22·1	26·1	33·7	37·7	2·0	33×0·9	5200
210	18	3·86	19·3	23·3	27·4	35·0	39·0	2·05	33×0·9	5650
240	18	4·12	20·6	24·6	28·8	36·4	40·4	2·1	33×0·9	6160
280	36	3·15	22·1	26·1	30·4	38·0	42·0	2·15	33×0·9	6770
310	36	3·31	23·2	27·2	31·6	39·2	43·2	2·2	33×0·9	7280
355	36	3·55	24·9	28·9	33·4	41·4	45·4	2·25	43×1·0	8140
400	36	3·76	26·3	30·3	34·9	42·9	46·9	2·3	43×1·0	8830
500	36	4·21	29·5	33·5	38·3	46·3	50·3	2·4	43×1·0	10330
625	60	3·65	32·9	36·9	41·9	49·9	53·9	2·5	43×1·0	12120
725	60	3·92	35·6	39·6	44·8	53·2	57·2	2·6	55×1·1	13740
800	60	4·12	37·1	41·1	46·5	54·9	58·9	2·7	55×1·1	14780
1000	90	3·76	41·4	45·4	51·0	59·4	63·4	2·8	55×1·1	17550

TABLE No. 136.—DIAMETER AND WEIGHT OF LEAD-COVERED SINGLE CONDUCTOR CABLE. Insulated with 2·5 mm. (= 98·5 mils) of paper.

Section of Conductor		Strand of Copper Wires	Thickness of Lead $\frac{D}{20}+0\cdot9$	Diameter in mm. over			Weight in kilog. per km.			
square inch	square mm.			Conductor	Paper	Lead	Copper	Paper	Impregnating Compound	Lead
0·050	32·25	19×1·47	1·5	7·4	12·4	15·4	287	86	69	745
·100	64·5	19×2·08	1·6	10·4	15·4	18·6	575	111	89	1039
·125	80·6	19×2·34	1·65	11·7	16·7	20·0	719	123	98	1153
·15	96·7	37×1·83	1·7	12·8	17·8	21·2	862	132	106	1260
·20	129	37×2·08	1·8	14·6	19·6	23·2	1150	148	118	1459
·25	161	37×2·34	1·95	16·4	21·4	25·3	1437	163	130	1672
·30	193	37×2·57	2·0	18·0	23·0	27·0	1724	177	142	1834
·35	226	37×2·79	2·1	19·5	24·5	28·7	2012	190	152	1995
·40	258	61×2·34	2·2	21·1	26·1	30·5	2300	203	162	2224
·50	322	61×2·57	2·3	23·1	28·1	32·7	2874	221	177	2497
·60	387	91×2·34	2·4	25·7	30·7	35·5	3449	238	190	2901
·70	452	91×2·49	2·5	27·4	32·4	37·4	4025	258	206	3117
·75	484	91×2·57	2·6	28·3	33·3	38·5	4311	266	213	3266
·80	516	91×2·64	2·6	29·0	34·0	39·2	4599	272	218	3400
·90	581	91×2·79	2·7	30·7	35·7	41·1	5173	287	230	3704
1·0	645	127×2·57	2·8	33·4	38·4	44·0	5748	310	248	4120

TABLE No. 137.—CONSTRUCTIONAL DATA FOR SINGLE CONDUCTOR, PAPER INSULATED, ARMOURED CABLE. With test wire for 3000 volts working pressure. Thickness of Paper Insulation = 2·5 mm. (= 98·5 mils).

Sectional Area of Conductor, sq. mm.	Details of Strand		Diameter in mm. over					Thickness of Lead Sheath, mm.	Dimensions of Steel Tape, mm.	Total Weight of Cable, kilog. per km.
	Number of Wires	Diam. of Wire, mm.	Copper	Paper	Lead	Steel Tape	Outer Serving			
10	3	2·06	5·0	10·0	13·0	20·2	24·2	1·5	20×0·8	1590
16	3	2·6	6·3	11·3	14·4	21·6	25·6	1·55	20×0·8	1800
25	6	2·3	6·9	11·9	15·0	22·2	26·2	1·55	20×0·8	1980
35	6	2·72	8·2	13·2	16·3	23·9	27·9	1·55	25×0·9	2340
50	6	3·26	9·8	14·8	18·0	25·6	29·6	1·6	25×0·9	2710
70	6	3·85	11·6	16·6	20·0	27·6	31·6	1·7	25×0·9	3092
95	18	2·59	13·0	18·0	21·5	29·1	33·1	1·75	25×0·9	3660
120	18	2·91	14·6	19·6	23·3	30·9	34·9	1·85	33×0·9	4180
150	18	3·26	16·3	21·3	25·2	32·8	36·8	1·95	33×0·9	4800
185	18	3·62	18·1	23·1	27·2	34·8	38·8	2·05	33×0·9	5460
210	18	3·86	19·3	24·3	28·5	36·1	40·1	2·1	33×0·9	5910
240	18	4·12	20·6	25·6	29·9	37·5	41·5	2·15	33×0·9	6370
280	36	3·15	22·1	27·1	31·5	39·1	43·1	2·2	33×0·9	6990
310	36	3·31	23·2	28·2	32·6	40·6	44·6	2·2	43×1·0	7660
355	36	3·55	24·9	29·9	34·5	42·5	46·5	2·3	43×1·0	8360
400	36	3·76	26·3	31·3	36·0	44·0	48·0	2·35	43×1·0	9070
500	36	4·21	29·5	34·5	39·4	47·4	51·4	2·45	43×1·0	10660
625	60	3·65	32·9	37·9	43·0	51·0	55·0	2·55	43×1·0	12470
725	60	3·92	35·6	40·6	45·9	54·3	58·3	2·65	55×1·1	14100
800	60	4·12	37·1	42·1	47·5	55·9	59·9	2·7	55×1·1	15150
1000	90	3·76	41·4	46·4	52·1	60·5	64·5	2·85	55×1·1	17960

TABLE No. 138.—PARTICULARS OF CONCENTRIC, PAPER INSULATED, LEAD COVERED CABLE. Thickness of Paper Insulation = 1·75 mm. (= 69 mils). (Weights given in kilog. per km.)

Conductor L.S.W.G.	Conductor Strand		Diam. over Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper mm.	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead, mm.
	No. of Wires	Diam. of Wire, mm.							No. of Wires	Diam. of Wire, mm.					Thickness mm.	Weight	
7/20	7	0·914	2·7	4·59	40·9	6·2	27	22	9	0·80	7·8	11·3	58	46	1·45	660	14·2
7/19	7	1·02	3·1	5·72	51·0	6·6	29	24	12	·80	8·2	11·7	60	48	1·5	707	14·7
7/18	7	1·22	3·7	8·18	72·9	7·2	33	26	17	·80	8·8	12·3	64	51	1·5	739	15·3
7/17	7	1·42	4·3	11·09	98·8	7·8	37	29	22	·80	9·4	12·9	67	54	1·55	800	16·0
7/16	7	1·63	4·9	14·61	130·2	8·4	40	32	29	·80	10·0	13·5	71	57	1·6	863	16·7
7/15	7	1·83	5·5	18·40	164·1	9·0	44	35	36	·80	10·6	14·1	75	60	1·6	897	17·3
7/14	7	2·03	6·1	22·66	201·9	9·6	48	38	36	·90	11·4	14·9	80	64	1·65	975	18·2
19/20	19	0·914	4·6	12·47	111·1	8·1	38	31	25	·80	9·7	13·2	69	55	1·55	817	16·3
19/19	19	1·02	5·1	15·53	138·3	8·6	42	33	31	·80	10·2	13·7	72	58	1·6	874	16·9
19/18	19	1·22	6·1	22·21	197·3	9·6	48	38	36	·89	11·4	14·9	80	64	1·65	975	18·2
19/17	19	1·42	7·1	30·09	268·2	10·6	54	43	33	1·08	12·8	16·3	88	70	1·7	1093	19·7
19/16	19	1·63	8·2	39·65	353·4	11·7	60	48	29	1·32	14·3	17·8	97	78	1·8	1260	21·4
19/15	19	1·83	9·2	49·98	445·3	12·7	66	53	30	1·46	15·6	19·1	105	84	1·85	1381	22·8
19/14	19	2·03	10·2	61·49	548·0	13·7	72	58	28	1·67	17·0	20·5	113	91	1·95	1564	24·4
19/13	19	2·34	11·7	81·71	728·2	15·2	81	65	27	1·97	19·1	22·6	126	101	2·05	1805	26·7
19/12	19	2·64	13·2	104·0	926·9	16·7	90	72	26	2·26	21·2	24·7	139	111	2·15	2062	29·0
37/16	37	1·63	11·4	77·2	688·1	14·9	80	64	28	1·88	18·7	22·2	124	99	2·0	1729	26·2
37/15	37	1·83	12·8	97·3	867·3	16·3	88	70	26	2·19	20·7	24·2	136	109	2·1	1973	28·1
37/14	37	2·03	14·2	119·8	1066·7	17·7	97	77	25	2·47	22·6	26·1	147	118	2·2	2224	30·5
61/16	61	1·63	14·7	127·3	1134·5	18·2	100	80	25	2·55	23·3	26·8	152	121	2·25	2335	31·3
61/15	61	1·83	16·5	160·4	1429·5	20·0	110	88	24	2·92	25·8	29·3	167	133	2·35	2657	34·0
61/14	61	2·03	18·3	197·4	1759·2	21·8	121	97	21	3·46	28·7	32·2	181	147	2·5	3099	37·2
91/14	91	2·03	22·3	294·5	2624·6	25·8	145	116	23	4·04	33·9	37·4	216	173	2·75	3914	42·9
91/13	91	2·34	25·7	391·3	3487·3	29·2	166	133	22	4·76	38·7	42·2	245	196	3·0	4844	48·2
91/12	91	2·64	29·0	498·1	4439·0	32·5	186	149	22	5·37	43·2	46·7	272	217	3·25	5799	53·2
127/14	127	2·03	26·4	411·0	3662·8	29·9	170	136	22	4·88	39·7	43·2	251	201	3·05	5039	49·3
127/13	127	2·34	30·4	546·2	4867·7	33·9	194	156	22	5·63	45·3	48·8	285	228	3·35	6240	55·5
127/12	127	2·64	34·3	695·2	6195·6	37·8	218	174	21	6·53	50·9	54·4	318	254	3·6	7458	61·6

TABLE No. 139.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·0 mm. (= 79 mils). (Weights given in kilog. per km.)

Conductor L.S.W.G.	Conductor Wires		Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead		Diam. over Lead, mm.
	No.	Diam., mm.							No. of Wires	Diam. of Wires, mm.					Thickness, mm.	Weight	
7/20	7	0·914	2·7	4·59	40·9	6·7	32	26	10	0·8	8·3	12·3	71	57	1·5	739	15·3
7/19	7	1·02	3·1	5·72	51·0	7·1	35	28	12	0·8	8·7	12·7	74	59	1·55	789	15·8
7/18	7	1·22	3·7	8·18	72·9	7·7	39	31	16	0·8	9·3	13·3	78	63	1·55	822	16·4
7/17	7	1·42	4·3	11·09	98·8	8·3	44	35	22	0·8	9·9	13·9	82	66	1·6	886	17·1
7/16	7	1·63	4·9	14·61	130·2	8·9	48	38	29	0·8	10·5	14·5	86	69	1·65	952	17·8
7/15	7	1·83	5·5	18·4	164·1	9·5	52	42	36	0·8	11·1	15·1	90	72	1·65	987	18·4
7/14	7	2·03	6·1	22·66	201·9	10·1	56	45	29	1·0	12·1	16·1	97	78	1·7	1081	19·5
19/20	19	0·914	4·6	12·47	111·1	8·6	46	37	25	0·8	10·2	14·2	84	68	1·6	903	17·4
19/19	19	1·02	5·1	15·53	138·3	9·1	49	43	31	0·8	10·7	14·7	88	70	1·65	964	18·0
19/18	19	1·22	6·1	22·21	197·3	10·1	56	45	28	1·0	12·1	16·1	97	78	1·7	1081	19·5
19/17	19	1·42	7·1	30·09	268·2	11·1	63	50	35	1·04	13·2	17·2	105	84	1·75	1184	20·7
19/16	19	1·63	8·2	39·65	353·4	12·2	71	57	33	1·24	14·7	18·7	116	93	1·85	1358	22·4
19/15	19	1·83	9·2	49·98	445·3	13·2	78	62	31	1·43	16·1	20·1	124	100	1·9	1486	23·8
19/14	19	2·03	10·2	61·49	548·0	14·2	84	67	30	1·62	17·4	21·4	134	107	1·95	1626	25·3
19/13	19	2·34	11·7	81·71	728·2	15·7	95	76	28	1·92	19·5	23·5	149	119	2·1	1920	27·7
19/12	19	2·64	13·2	104·0	926·9	17·2	105	84	27	2·23	21·7	25·7	164	131	2·2	2192	30·1
37/16	37	1·63	11·4	77·2	688·1	15·4	93	74	29	1·86	19·1	23·1	146	117	2·05	1842	27·2
37/15	37	1·83	12·8	97·3	867·3	16·8	102	82	27	2·14	21·1	25·1	160	128	2·15	2093	29·4
37/14	37	2·03	14·2	119·8	1066·7	18·2	112	90	26	2·42	23·0	27·0	173	138	2·25	2351	31·5
61/16	61	1·63	14·7	127·3	1134·5	18·7	116	93	26	2·5	23·7	27·7	178	142	2·3	2465	32·3
61/15	61	1·83	16·5	160·4	1429·5	20·5	128	102	25	2·86	26·2	30·2	195	156	2·4	2795	35·0
61/14	61	2·03	18·3	197·4	1759·2	22·3	140	112	24	3·23	28·8	32·8	213	171	2·55	3220	37·9
91/14	91	2·03	22·3	294·5	2624·6	26·3	168	134	23	4·05	34·4	38·4	252	201	2·8	4421	44·0
91/13	91	2·34	25·7	391·3	3487·3	29·7	192	153	22	4·74	39·2	43·2	285	228	3·05	5039	49·3
91/12	91	2·64	29·0	498·1	4439·0	33·0	215	172	21	5·46	43·9	47·9	317	254	3·3	6035	54·5
127/14	127	2·03	26·4	411·0	3662·8	30·4	196	157	19	5·25	40·9	44·9	297	237	3·15	5395	51·1
127/13	127	2·34	30·4	546·2	4867·7	34·4	224	180	22	5·68	45·8	49·8	330	264	3·4	6461	56·6
127/12	127	2·64	34·3	695·2	6195·6	38·3	251	201	21	6·47	51·2	55·2	368	294	3·65	7674	62·5

TABLE No 140.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·25 mm. (= 89 mils). (Weights given are kilog. per km.)

Conductor L.S.W.G.	Conductor Wires		Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead		Diam. over Lead, mm.
	No.	Diam. mm.							No. of Wires	Diam. of Wires, mm.					Thickness, mm.	Weight	
7/20	7	0·914	2·7	4·59	40·9	7·2	39	31	9	0·8	8·8	13·3	86	69	1·55	822	16·4
7/19	7	1·02	3·1	5·72	51·0	7·6	42	33	12	0·8	9·2	13·7	89	71	1·6	874	16·9
7/18	7	1·22	3·7	8·18	72·9	8·2	46	37	17	0·8	9·8	14·3	94	75	1·6	909	17·5
7/17	7	1·42	4·3	11·09	98·8	8·8	51	41	22	0·8	10·4	14·9	98	79	1·65	975	18·2
7/16	7	1·63	4·9	14·61	130·2	9·4	56	45	29	0·8	11·0	15·5	103	82	1·7	1045	18·9
7/15	7	1·83	5·5	18·4	164·1	10·0	60	48	36	0·81	11·6	16·1	108	86	1·7	1081	19·5
7/14	7	2·03	6·1	22·66	201·9	10·6	65	52	36	0·9	12·4	16·9	114	91	1·75	1166	20·4
19/20	19	0·914	4·6	12·47	111·1	9·1	53	43	25	0·8	10·7	15·2	101	81	1·65	993	18·5
19/19	19	1·02	5·1	15·53	138·3	9·6	57	46	31	0·8	11·2	15·7	105	84	1·7	1057	19·1
19/18	19	1·22	6·1	22·21	197·3	10·6	65	52	36	0·89	12·4	16·9	114	91	1·75	1166	20·4
19/17	19	1·42	7·1	30·09	268·2	11·6	73	58	36	1·03	13·7	18·2	124	99	1·8	1286	21·8
19/16	19	1·63	8·2	39·65	353·4	12·7	81	65	36	1·18	15·1	19·6	135	108	1·9	1459	23·4
19/15	19	1·83	9·2	49·98	445·3	13·7	89	71	34	1·37	16·4	20·9	145	116	1·95	1591	24·8
19/14	19	2·03	10·2	61·49	548·0	14·7	97	78	32	1·57	17·8	22·3	156	125	2·0	1736	26·3
19/13	19	2·34	11·7	81·71	728·2	16·2	108	87	30	1·87	19·9	24·4	172	138	2·1	1988	28·6
19/12	19	2·64	13·2	104·0	926·9	17·7	120	96	28	2·18	22·1	26·6	189	151	2·25	2319	31·1
37/16	37	1·63	11·4	77·2	688·1	15·9	106	85	30	1·81	19·5	24·0	169	135	2·1	1958	28·2
37/15	37	1·83	12·8	97·3	867·3	17·3	117	94	29	2·07	21·4	25·9	184	147	2·2	2208	30·3
37/14	37	2·03	14·2	119·8	1066·7	18·7	128	102	27	2·38	23·4	27·9	199	160	2·3	2481	32·5
61/16	61	1·63	14·7	127·3	1134·5	19·2	132	105	27	2·45	24·1	28·6	205	164	2·35	2598	33·3
61/15	61	1·83	16·5	160·4	1429·5	21·0	146	117	30	2·61	26·2	30·7	221	177	2·45	2901	35·6
61/14	61	2·03	18·3	197·4	1759·2	22·8	160	128	25	3·17	29·1	33·6	244	195	2·6	3362	38·8
91/14	91	2·03	22·3	294·5	2624·6	26·8	191	153	24	3·96	34·7	39·2	287	230	2·85	4281	44·9
91/13	91	2·34	25·7	391·3	3487·3	30·2	217	174	23	4·66	39·5	44·0	325	260	3·1	5215	50·2
91/12	91	2·64	29·0	498·1	4439·0	33·5	243	194	23	5·25	44·0	48·5	360	288	3·35	6204	55·2
127/14	127	2·03	26·4	411·0	3662·8	30·9	223	178	23	4·77	40·4	44·9	332	265	3·15	5406	51·2
127/13	127	2·34	30·4	546·2	4867·7	34·9	254	203	22	5·63	46·2	50·7	377	301	3·4	6570	57·5
127/12	127	2·64	34·3	695·2	6195·6	38·8	284	227	22	6·35	51·5	56·0	380	304	3·7	7890	63·4

TABLE No. 141.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·5 mm. (= 98·5 mils). (Weights given are kilog. per kilometre.)

Conductor, L.S.W.G.	Conductor Wires No.	Conductor Wires Diam. mm.	Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Outer Conductor No. of Wires	Outer Conductor Diam. of Wires, mm.	Diam. over Conductor, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead Thickness, mm.	Lead Weight	Diam. over Lead, mm.
7/20	7	0·914	2·7	4·59	40·9	7·7	45	36	9	0·80	9·3	14·3	102	82	1·6	909	17·5
7/19	7	1·02	3·1	5·72	51·0	8·1	48	39	12	·80	9·7	14·7	105	84	1·65	964	18·0
7/18	7	1·22	3·7	8·18	72·9	8·7	54	43	17	·80	10·3	15·3	111	89	1·65	999	18·6
7/17	7	1·42	4·3	11·09	98·8	9·3	59	47	22	·80	10·9	15·9	116	93	1·7	1069	19·3
7/16	7	1·63	4·9	14·61	130·2	9·9	64	51	29	·80	11·5	16·5	121	97	1·75	1141	20·0
7/15	7	1·83	5·5	18·4	164·1	10·5	69	55	36	·80	12·1	17·1	126	101	1·75	1178	20·6
7/14	7	2·03	6 1	22·66	201·9	11·1	74	60	36	·90	12·9	17·9	133	107	1·8	1266	21·5
19/20	19	0·914	4·6	12·47	111·1	9·6	61	49	25	·80	11·2	16·2	118	95	1·7	1087	19·6
19/19	19	1·02	5·1	15·53	138·3	10·1	66	53	31	·80	11·7	16·7	123	98	1·75	1153	20·2
19/18	19	1·22	6·1	22·21	197·3	11·1	74	60	36	·89	12·9	17·9	133	107	1·8	1266	21·5
19/17	19	1·42	7·1	30·09	268·2	12·1	83	66	36	1·03	14·2	19·2	144	115	1·85	1391	22·9
19/16	19	1·63	8·2	39·65	353·4	13·2	93	74	36	1·18	15·6	20·6	156	125	1·95	1571	24·5
19/15	19	1·83	9·2	49·98	445·3	14·2	101	81	35	1·35	16·9	21·9	168	134	2·0	1717	25·9
19/14	19	2·03	10·2	61·49	548·0	15·2	110	88	34	1·52	18·2	23·2	179	143	2·05	1849	27·3
19/13	19	2·34	11·7	81·71	728·2	16·7	123	98	31	1·83	20·4	25·4	198	158	2·15	2116	29·7
19/12	19	2·64	13·2	104·0	926·9	18·2	136	109	30	2·1	22·4	27·4	215	172	2·25	2383	31·9
37/16	37	1·63	11·4	77·2	688·1	16·4	120	96	32	1·76	19·9	24·9	194	155	2·15	2077	29·2
37/15	37	1·83	12·8	97·3	867·3	17·8	132	106	30	2·03	21·9	26·9	211	169	2·25	2343	31·4
37/14	37	2·03	14·2	119·8	1066·7	19·2	144	115	29	2·29	23·8	28·8	227	182	2·35	2615	33·5
61/16	61	1·63	14·7	127·3	1134·5	19·7	149	119	29	2·37	24·4	29·4	234	186	2·35	2665	34·1
61/15	61	1·83	16·5	160·4	1429·5	21·5	164	131	27	2·75	27·0	32·0	255	204	2·5	3081	37·0
61/14	61	2·03	18·3	197·4	1759·2	23·3	180	144	26	3·11	29·5	34·5	277	221	2·65	3516	39·8
91/14	91	2·03	22·3	294·5	2624·6	27·3	214	171	25	3·87	35·0	40·0	324	259	2·9	4444	45·8
91/13	91	2·34	25·7	391·3	3487·3	30·7	244	195	23	4·65	40·0	45·0	367	294	3·15	5418	51·3
91/12	91	2·64	29·0	498·1	4439·0	34·0	272	218	23	5·25	44·5	49·5	406	325	3·4	6424	56·3
127/14	127	2·03	26·4	411·0	3662·8	31·4	250	200	24	4·67	40·7	45·7	373	299	3·2	5589	52·1
127/13	127	2·34	30·4	546·2	4867·7	35·4	284	227	23	5·5	46·4	51·4	423	338	3·5	6863	58·4
127/12	127	2·64	34·3	695·2	6195·6	39·3	318	254	22	6·34	52·0	57·0	471	377	3·75	8138	64·5

TABLE No. 142.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·75 mm. (= 108 mils). (Weights given are kilog. per km.)

Conductor L.S.W.G.	Conductor Wires		Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead, mm.
	No.	Diam. mm.							No. of Wires	Diam. of Wire, mm.					Thickness, mm.	Weight	
7/20	7	0·914	2·7	4·59	40·9	8·2	52	42	9	0·8	9·8	15·3	119	95	1·65	999	18·6
7/19	7	1·02	3·1	5·72	51·0	8·6	56	45	11	·8	10·2	15·7	123	99	1·7	1057	19·1
7/18	7	1·22	3·7	8·18	72·9	9·2	61	49	17	·8	10·8	16·3	129	103	1·7	1093	19·7
7/17	7	1·42	4·3	11·09	98·8	9·8	67	54	22	·8	11·4	16·9	134	108	1·75	1166	20·4
7/16	7	1·63	4·9	14·61	130·2	10·4	73	58	29	·8	12·0	17·5	140	112	1·8	1240	21·1
7/15	7	1·83	5·5	18·4	164·1	11·0	78	63	36	·81	12·6	18·1	146	117	1·8	1279	21·7
7/14	7	2·03	6·1	22·66	201·9	11·6	84	67	36	·9	13·4	18·9	154	123	1·85	1371	22·6
19/20	19	0·914	4·6	12·47	111·1	10·1	70	56	25	·8	11·7	17·2	137	110	1·75	1184	20·7
19/19	19	1·02	5·1	15·53	138·3	10·6	75	60	31	·8	12·2	17·7	142	114	1·8	1254	21·3
19/18	19	1·22	6·1	22·21	197·3	11·6	84	67	36	·89	13·4	18·9	154	123	1·85	1371	22·6
19/17	19	1·42	7·1	30·09	268·2	12·6	94	75	36	1·03	14·7	20·2	166	133	1·9	1499	24·0
19/16	19	1·63	8·2	39·65	353·4	13·7	104	83	36	1·19	16·1	21·6	179	143	2·0	1686	25·6
19/15	19	1·83	9·2	49·98	445·3	14·7	114	91	36	1·33	17·4	22·9	192	153	2·05	1827	27·0
19/14	19	2·03	10·2	61·49	548·0	15·7	123	99	36	1·48	18·7	24·2	204	163	2·1	1973	28·4
19/13	19	2·34	11·7	81·71	728·2	17·2	137	110	33	1·78	20·8	26·3	221	179	2·2	2240	30·7
19/12	19	2·64	13·2	104·0	926·9	18·7	152	121	31	2·07	22·8	28·3	243	194	2·3	2514	32·9
37/16	37	1·63	11·4	77·2	688·1	16·9	134	108	33	1·73	20·4	25·9	220	176	2·2	2208	30·3
37/15	37	1·83	12·8	97·3	867·3	18·3	148	118	32	1·97	22·2	27·7	237	190	2·3	2465	32·3
37/14	37	2·03	14·2	119·8	1066·7	19·7	161	129	30	2·26	24·2	29·7	256	205	2·4	2752	34·5
61/16	61	1·63	14·7	127·3	1134·5	20·2	166	133	30	2·33	24·9	30·4	263	210	2·4	2812	35·2
61/15	61	1·83	16·5	160·4	1429·5	22·0	183	146	28	2·7	27·4	32·9	287	229	2·55	3229	38·0
61/14	61	2·03	18·3	197·4	1759·2	23·8	200	160	27	3·05	29·9	35·4	310	248	2·65	3602	40·7
91/14	91	2·03	22·3	294·5	2624·6	27·8	238	191	25	3·87	35·5	41·0	364	291	2·95	4631	46·9
91/13	91	2·34	25·7	391·3	3487·3	31·2	270	216	24	4·55	40·3	45·8	409	327	3·2	5601	52·2
91/12	91	2·64	29·0	498·1	4139·0	34·5	302	241	24	5·13	44·8	50·3	452	362	3·4	6524	57·1
127/14	127	2·03	26·4	411·0	3662·8	31·9	277	222	24	4·67	41·2	46·7	418	334	3·25	5799	53·2
127/13	127	2·34	30·4	546·2	4867·7	35·9	315	252	23	5·5	46·9	52·4	472	378	3·5	6988	59·4
127/12	127	2·64	34·3	695·2	6195·6	39·8	352	282	23	6·21	52·2	57·7	522	418	3·8	8348	65·3

TABLE No. 143.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 3·0 mm. (= 118 mils). (Weights given in kilog. per km.)

Conductor L.S.W.G.	Conductor Wires No.	Conductor Wires Diam., mm.	Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm,	Paper, weight	Impregnating Compound, weight	Outer Conductor No. of Wires	Outer Conductor Diam. of Wires, mm.	Diam. over Copper, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead Thickness, mm.	Lead Weight	Diam. over Lead, mm.
7/20	7	0·914	2·7	4·59	40·9	8·7	59	47	9	0·8	10·3	16·3	138	110	1·7	1093	19·7
7/19	7	1·02	3·1	5·72	51·0	9·1	63	51	12	0·8	10·7	16·7	142	114	1·75	1153	20·2
7/18	7	1·22	3·7	8·18	72·9	9·7	70	56	17	0·8	11·3	17·3	148	119	1·75	1191	20·8
7/17	7	1·42	4·3	11·09	98·8	10·3	76	61	22	0·8	11·9	17·9	155	124	1·8	1266	21·5
7/16	7	1·63	4·9	14·61	130·2	10·9	82	66	29	0·8	12·5	18·5	161	129	1·85	1345	22·2
7/15	7	1·83	5·5	18·4	164·1	11·5	88	71	36	0·81	13·1	19·1	167	134	1·85	1384	22·8
7/14	7	2·03	6·1	22·66	201·9	12·1	94	76	36	0·89	13·9	19·9	175	140	1·9	1479	23·7
19/20	19	0·914	4·6	12·47	111·1	10·6	79	63	25	0·8	12·2	18·2	158	126	1·8	1286	21·8
19/19	19	1·02	5·1	15·53	138·3	11·1	84	67	31	0·8	12·7	18·7	163	130	1·85	1358	22·4
19/18	19	1·22	6·1	22·21	197·3	12·1	94	76	36	0·87	13·8	19·8	174	139	1·9	1473	23·6
19/17	19	1·42	7·1	30·09	268·2	13·1	105	84	36	1·03	15·2	21·2	189	151	1·95	1612	25·1
19/16	19	1·63	8·2	39·65	353·4	14·2	116	93	36	1·18	16·6	22·6	203	163	2·05	1805	26·7
19/15	19	1·83	9·2	49·98	445·3	15·2	127	101	36	1·33	17·9	23·9	217	173	2·1	1950	28·1
19/14	19	2·03	10·2	61·49	548·0	16·2	137	110	36	1·48	19·2	25·2	230	184	2·15	2100	29·5
19/13	19	2·34	11·7	81·71	728·2	17·7	152	122	34	1·57	20·8	26·8	247	197	2·25	2335	31·3
19/12	19	2·64	13·2	104·0	926·9	19·2	168	134	32	2·04	23·3	29·3	273	218	2·35	2657	34·0
37/16	37	1·63	11·4	77·2	688·1	17·4	149	119	35	1·68	20·8	26·8	247	197	2·25	2335	31·3
37/15	37	1·83	12·8	97·3	867·3	18·8	164	131	33	1·94	22·7	28·7	267	213	2·35	2606	33·4
37/14	37	2·03	14·2	119·8	1066·7	20·2	178	143	31	2·22	24·6	30·6	286	229	2·45	2892	35·5
61/16	61	1·63	14·7	127·3	1134·5	20·7	184	147	31	2·29	25·3	31·3	293	235	2·45	2953	36·2
61/15	61	1·83	16·5	160·4	1429·5	22·5	202	162	28	2·7	27·9	33·9	320	256	2·6	3390	39·1
61/14	61	2·03	18·3	197·4	1759·2	24·3	221	177	28	3·0	30·3	36·3	345	276	2·7	3761	41·7
91/14	91	2·03	22·3	294·5	2624·6	28·3	262	210	26	3·8	35·9	41·9	403	323	3·0	4811	47·9
91/13	91	2·34	25·7	391·3	3487·3	31·7	298	238	25	4·47	40·6	46·6	452	362	3·25	5787	53·1
91/12	91	2·64	29·0	498·1	4439·0	35·0	332	265	24	5·14	45·2	51·2	500	400	3·45	6734	58·1
127/14	127	2·03	26·4	411·0	3662·8	32·4	305	244	25	4·58	41·6	47·6	462	370	3·3	6000	54·2
127/13	127	2·34	30·4	546·2	4867·7	36·4	346	277	24	5·38	47·2	53·2	520	416	3·55	7196	60·3
127/12	127	2·64	34·4	695·2	6195·6	40·4	388	310	23	6·21	52·8	58·8	578	460	3·85	8675	66·5

TABLE No. 144.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 3·2 mm. (= 126 mils). (Weights given are kilogrammes per kilometre.)

Conductor L.S.W.G.	Conductor Wires No.	Conductor Wires Diam., mm.	Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Outer Conductor No. of Wires	Outer Conductor Diam. of Wires, mm.	Diam. over Conductor, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead Thickness, weight	Lead Weight	Diam. over Lead, mm.
7/20	7	0·914	2·7	4·59	40·9	9·1	65	52	9	0·8	10·7	17·1	154	123	1·75	1178	20·6
7/19	7	1·02	3·1	5·72	51·0	9·5	70	56	12	0·8	11·1	17·5	158	126	1·8	1240	21·1
7/18	7	1·22	3·7	8·18	72·9	10·1	76	61	17	0·8	11·7	18·1	165	132	1·8	1279	21·7
7/17	7	1·42	4·3	11·09	98·8	10·7	83	66	22	0·8	12·3	18·7	171	137	1·85	1358	22·4
7/16	7	1·63	4·9	14·61	130·2	11·3	90	72	29	0·8	12·9	19·3	178	142	1·85	1398	23·0
7/15	7	1·83	5·5	18·4	164·1	11·9	96	77	36	0·81	13·5	19·9	185	148	1·9	1479	23·7
7/14	7	2·03	6·1	22·66	201·9	10·5	103	82	36	0·9	12·3	18·7	171	137	1·85	1358	22·4
19/20	19	0·914	4·6	12·47	111·1	11·0	86	69	25	0·8	12·6	19·0	175	140	1·85	1378	22·7
19/19	19	1·02	5·1	15·53	138·3	11·5	92	74	31	0·81	13·1	19·5	180	144	1·9	1452	23·3
19/18	19	1·22	6·1	22·21	197·3	12·5	103	82	36	0·89	14·3	20·7	194	155	1·95	1578	24·6
19/17	19	1·42	7·1	30·09	268·2	13·5	114	91	36	1·04	15·6	22·0	208	166	2·0	1714	26·0
19/16	19	1·63	8·2	39·65	353·4	14·6	126	101	36	1·19	17·0	23·4	223	179	2·05	1864	27·5
19/15	19	1·83	9·2	49·98	445·3	15·6	137	110	36	1·33	18·3	24·7	238	190	2·15	2062	29·0
19/14	19	2·03	10·2	61·49	548·0	16·6	148	119	36	1·48	19·6	26·0	252	202	2·2	2216	30·4
19/13	19	2·34	11·7	81·71	728·2	18·1	165	132	36	1·70	21·5	27·9	273	219	2·3	2481	33·5
19/12	19	2·64	13·2	104·0	926·9	19·6	181	145	33	2·01	23·6	30·0	296	237	2·4	2777	34·8
37/16	37	1·63	11·4	77·2	688·1	17·8	161	129	36	1·65	21·1	27·5	269	215	2·3	2448	32·1
37/15	37	1·83	12·8	97·3	867·3	19·2	177	142	34	1·91	23·0	29·4	290	232	2·35	2665	34·1
37/14	37	2·03	14·2	119·8	1066·7	20·6	192	154	32	2·19	25·0	31·4	312	249	2·45	2962	36·3
61/16	61	1·63	14·7	127·3	1134·5	21·1	198	158	32	2·25	25·6	32·0	318	255	2·5	3081	37·0
61/15	61	1·83	16·5	160·4	1429·5	22·9	218	174	30	2·61	28·1	34·5	346	277	2·65	3516	39·8
61/14	61	2·03	18·3	197·4	1759·2	24·7	238	190	29	2·95	30·6	37·0	374	299	2·75	3905	42·5
91/14	91	2·03	22·3	294·5	2624·6	28·7	282	225	27	3·73	36·2	42·6	436	349	3·05	4973	48·7
91/13	91	2·34	25·7	391·3	3487·3	32·1	320	256	26	4·38	41·9	48·3	499	399	3·3	6082	54·9
91/12	91	2·64	29·0	498·1	4439·0	35·4	356	285	24	5·14	45·7	52·1	541	433	3·5	6950	59·1
127/14	127	2·03	26·4	411·0	3662·8	32·8	327	262	25	4·58	42·0	48·4	500	400	3·3	6094	55·0
127/13	127	2·34	30·4	546·2	4867·7	36·8	372	297	24	5·38	47·6	54·0	562	450	3·6	7407	61·2
127/12	127	2·64	34·3	695·2	6195·6	40·7	415	332	24	6·08	52·9	59·3	620	496	3·9	8804	67·1

TABLE No. 145.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 1·75 mm. (= 69 mils). Weights given in kilog. per km.

Con-ductor Section, sq. in.	Conductor Wires		Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm.	Paper, weight	Im-preg-nating Com-pound, weight	Outer Conductor		Diam. over Con-ductor, mm.	Diam. over Paper, mm.	Paper, weight	Im-preg-nating Com-pound, weight	Lead Sheath		Diam. over Lead, mm.
	No.	Diam. mm.							No. of Wires	Diam. of Wires, mm.					Thick-ness, mm.	Weight	
0·025	7	1·71	5·1	16·3	144	8·6	42	33	33	0·8	10·2	13·7	72	58	1·6	874	16·9
·050	19	1·47	7·4	32·3	287	10·9	55	44	32	1·13	13·2	16·7	90	72	1·75	1153	20·2
·075	19	1·8	9·0	48·4	431	12·5	65	52	29	1·46	15·4	18·9	104	83	1·85	1371	22·6
·100	19	2·08	10·4	64·5	575	13·9	74	59	27	1·75	17·4	20·9	116	93	1·95	1591	24·8
·125	19	2·33	11·7	80·64	718	15·2	81	65	26	1·99	19·2	22·7	127	101	2·05	1812	26·8
·150	19	2·54	12·7	96·77	862	16·2	87	70	25	2·22	20·6	24·1	135	108	2·1	1965	28·3
·175	19	2·75	13·8	112·9	1006	17·3	94	75	25	2·4	22·1	25·6	144	115	2·2	2185	30·0
·200	19	2·94	14·7	129·0	1150	18·2	100	80	24	2·62	23·4	26·9	152	122	2·25	2343	31·4
·225	19	3·12	15·6	145·18	1293	19·1	105	84	24	2·78	24·7	28·2	160	128	2·3	2506	32·8
·250	19	3·29	16·5	161·25	1436	20·0	110	88	23	2·99	26·0	29·5	168	134	2·4	2735	34·3
·275	19	3·45	17·3	177·42	1580	20·8	115	92	23	3·14	27·1	30·6	175	140	2·45	2892	35·5
·300	19	3·6	18·0	193·52	1724	21·5	119	96	23	3·28	28·1	31·6	181	144	2·5	3045	36·6
·325	19	3·75	18·8	209·68	1868	22·3	124	99	23	3·41	29·1	32·6	187	149	2·55	3202	37·7
·350	19	3·89	19·5	225·89	2013	23·0	129	103	22	3·62	30·2	33·7	193	155	2·6	3371	38·9
·375	19	4·03	20·2	241·9	2156	23·7	133	106	22	3·74	31·2	34·7	199	159	2·65	3535	40·0
·400	19	4·15	20·8	258·1	2299	24·3	136	109	22	3·87	32·0	35·5	204	163	2·7	3684	40·9
·425	37	3·07	21·5	274·2	2443	25·0	141	112	22	3·99	33·0	36·5	210	168	2·75	3855	42·0
·450	37	3·16	22·1	290·36	2587	25·6	144	115	22	4·1	33·8	37·3	215	172	2·75	3934	42·8
·475	37	3·25	22·8	306·5	2731	26·3	148	119	22	4·21	34·7	38·2	220	176	2·8	4101	43·8
·500	37	3·33	23·3	322·6	2875	26·8	152	121	21	4·43	35·7	39·2	226	181	2·85	4281	44·9

TABLE No. 145.—CONSTRUCTION DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 1·75 mm. (≐ 69 mils). Weights given in kilog. per km.—*continued.*

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand, mm.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor, mm.	Diam. over Paper, mm.	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead, mm.
	No.	Diam. mm.							No. of Wires	Diam. of Wires, mm.					Thickness, mm.	Weight	
0·525	37	3·42	23·9	338·76	3019	27·4	155	124	21	4·54	36·5	40·0	231	185	2·9	4444	45·8
·550	37	3·5	24·5	354·9	3163	28·0	159	127	21	4·64	37·3	40·8	236	189	2·95	4610	46·7
·575	37	3·57	25·0	371·04	3306	28·5	162	129	21	4·75	38·0	41·5	240	192	3·0	4769	47·5
·600	37	3·65	25·6	387·15	3450	29·1	165	132	21	4·85	38·8	42·3	245	196	3·0	4854	48·3
·625	37	3·73	26·1	403·28	3594	29·6	168	135	21	4·95	39·5	43·0	249	200	3·05	5017	49·1
·650	37	3·8	26·6	419·4	3738	30·1	171	137	21	5·04	40·2	43·7	254	203	3·1	5182	49·9
·675	37	3·87	27·1	435·52	3881	30·6	175	140	21	5·14	40·9	44·4	258	206	3·1	5260	50·6
·700	37	3·94	27·6	451·65	4025	31·1	178	142	21	5·24	41·6	45·1	262	210	3·15	5429	51·4
·725	37	4·01	28·1	467·8	4169	31·6	181	144	21	5·33	42·3	45·8	266	213	3·2	5601	52·2
·750	37	4·08	28·6	483·95	4313	32·1	184	147	21	5·42	12·9	46·4	270	216	3·2	5669	52·8
·775	37	4·15	29·1	500·0	4457	32·6	187	149	21	5·51	43·6	17·1	271	219	3·25	5845	53·6
·800	37	4·22	29·5	516·2	4601	33·0	189	151	21	5·6	44·2	47·7	278	222	3·3	6012	54·3
·825	61	3·34	30·1	532·3	4744	33·6	193	154	21	5·69	45·0	48·5	283	226	3·35	6204	55·2
·850	61	3·39	30·5	548·45	4889	34·0	195	156	21	5·77	45·5	49·0	286	229	3·35	6264	55·7
·875	61	3·44	31·0	564·58	5033	34·5	198	158	21	5·85	46·2	49·7	290	232	3·4	6449	56·5
·900	61	3·48	31·3	580·7	5176	34·8	200	160	20	6·08	47·0	50·5	295	236	3·4	6546	57·3
·925	61	3·53	31·8	596·8	5319	35·3	203	162	20	6·17	47·6	51·1	298	239	3·45	6722	58·0
·950	61	3·58	32·2	612·96	5463	35·7	205	164	20	6·25	48·2	51·7	302	242	3·5	6900	58·7
·975	61	3·63	32·7	629·09	5607	36·2	208	167	20	6·33	48·9	52·4	306	215	3·5	6988	59·4
1·000	61	3·67	33·0	645·14	5750	36·5	210	168	20	6·41	49·3	52·8	309	247	3·5	7038	59·8

TABLE No. 146.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·0 mm. (= 79 mils). (Weights given in kilog. per km., and dimensions in mm.)

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead
	No.	Diam.							No. of Wires	Diam. of Wires					Thickness	Weight	
0·025	7	1·71	5·1	16·3	144	9·1	49	39	33	0·8	10·7	14·7	88	70	1·65	964	18·0
·050	19	1·47	7·4	32·3	287	11·4	65	52	35	1·09	13·6	17·6	108	86	1·8	1247	21·2
·075	19	1·80	9·0	48·4	431	13·0	76	61	31	1·41	15·8	19·8	123	98	1·9	1473	23·6
·100	19	2·08	10·4	64·5	575	14·4	86	69	29	1·69	17·8	21·8	137	109	2·0	1700	25·8
·125	19	2·33	11·7	80·6	718	15·7	95	76	28	1·92	19·5	23·5	149	119	2·1	1920	27·7
·150	19	2·54	12·7	96·8	862	16·7	102	81	27	2·14	21·0	25·0	159	127	2·15	2085	29·3
·175	19	2·75	13·8	112·9	1006	17·8	109	87	26	2·36	22·5	26·5	169	136	2·25	2311	31·0
·200	19	2·94	14·7	129·0	1150	18·7	116	93	25	2·57	23·8	27·8	178	143	2·30	2473	32·4
·225	19	3·12	15·6	145·2	1293	19·6	122	97	25	2·72	25·0	29·0	187	149	2·35	2631	33·7
·250	19	3·29	16·5	161·2	1436	20·5	128	102	24	2·93	26·4	30·4	196	157	2·40	2812	35·2
·275	19	3·45	17·3	177·4	1580	21·3	133	107	24	3·07	27·4	31·4	203	163	2·45	2962	36·3
·300	19	3·60	18·0	193·5	1724	22·0	138	111	24	3·21	28·4	32·4	210	168	2·50	3116	37·4
·325	19	3·75	18·8	209·7	1868	22·8	144	115	24	3·34	29·5	33·5	218	175	2·60	3353	38·7
·350	19	3·89	19·5	225·9	2013	23·5	149	119	23	3·54	30·6	34·6	226	181	2·65	3526	39·9
·375	19	4·03	20·2	241·9	2156	24·2	154	123	23	3·66	31·5	35·5	232	185	2·70	3684	40·9
·400	19	4·15	20·8	258·1	2299	24·8	158	126	23	3·78	32·4	36·4	238	190	2·70	3771	41·8
·425	37	3·07	21·5	274·2	2443	25·5	162	130	23	3·9	33·3	37·3	244	195	2·75	3934	42·8
·450	37	3·16	22·1	290·4	2587	26·1	167	133	22	4·1	34·3	38·3	251	201	2·80	4111	43·9
·475	37	3·25	22·8	306·5	2731	26·8	171	137	22	4·21	35·2	39·2	257	206	2·85	4281	44·9
·500	37	3·33	23·3	322·6	2875	27·3	175	140	22	4·32	35·9	39·9	262	210	2·90	4433	45·7

TABLE No. 146.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·0 mm. and 79 mils (Weights given in kilog. per km., and dimensions in mm.)—*continued.*

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand.	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead
	No.	Diam.							No. of Wires	Diam. of Wires					Thickness	Weight	
0·525	37	3·42	23·9	338·8	3019	27·9	179	143	22	4·43	36·7	40·7	268	214	2·95	4599	46·6
·550	37	3·5	24·5	354·9	3163	28·5	183	147	22	4·54	37·6	41·6	274	219	3·00	4779	47·6
·575	37	3·57	25·0	371·0	3306	29·0	187	149	22	4·63	38·3	42·3	279	223	3·00	4854	48·3
·600	37	3·65	25·6	387·2	3450	29·6	191	153	22	4·74	39·1	43·1	284	227	3·05	5028	49·2
·625	37	3·73	26·1	403·3	3594	30·1	194	155	22	4·83	39·8	43·8	289	231	3·10	5193	50·0
·650	37	3·8	26·6	419·4	3738	30·6	198	158	22	4·93	40·5	44·5	294	235	3·15	5361	50·8
·675	37	3·87	27·1	435·5	3881	31·1	201	161	22	5·02	41·1	45·1	298	238	3·15	5429	51·4
·700	37	3·94	27·6	451·6	4025	31·6	205	164	22	5·12	41·8	45·8	303	242	3·20	5601	52·2
·725	37	4·01	28·1	467·8	4169	32·1	208	167	21	5·33	42·8	46·8	310	248	3·25	5810	53·3
·750	37	4·08	28·6	484·0	4313	32·6	212	169	21	5·42	43·4	47·1	314	251	3·25	5880	53·9
·775	37	4·15	29·1	500·0	4457	33·1	215	172	21	5·51	44·1	48·1	319	255	3·30	6059	54·7
·800	37	4·22	29·5	516·2	4601	33·5	218	175	21	5·60	44·7	48·7	323	258	3·35	6228	55·4
·825	61	3·34	30·1	532·3	4744	34·1	222	178	21	5·69	45·5	49·5	328	263	3·4	6424	56·3
·850	61	3·39	30·5	548·5	4889	34·5	225	180	21	5·77	46·0	50·0	332	266	3·4	6485	56·8
·875	61	3·44	31·0	564·6	5033	35·0	229	183	31	5·88	46·8	50·8	337	270	3·4	6583	57·6
·900	61	3·48	31·3	580·7	5176	35·3	230	184	21	5·94	47·2	51·2	340	272	3·45	6734	58·1
·925	61	3·53	31·8	596·8	5319	35·8	234	187	21	6·02	47·8	51·8	344	276	3·5	6914	58·8
·950	61	3·58	32·2	613·0	5463	36·2	236	189	21	6·10	48·2	52·2	347	278	3·5	6963	59·2
·975	61	3·63	32·7	629·1	5607	36·7	240	192	21	6·18	49·1	53·1	353	283	3·55	7184	60·2
1·000	61	3·67	33·0	645·1	5750	37·0	242	194	21	6·26	49·5	53·5	356	285	3·6	7342	60·7

TABLE NO. 147.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE.
Thickness of Paper Insulation = 2·25 mm. (= 88·5 mils). (Weights given in kilog. per km. Dimensions in mm.)

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead
	No.	Diam.							No. of Wires	Diam. of Wires					Thickness	Weight	
0·025	7	1·71	5·1	16·3	144	9·6	57	46	33	0·8	11·2	15·7	105	84	1·7	1057	19·1
·050	19	1·47	7·4	32·3	287	11·9	75	60	36	1·09	14·1	18·6	127	102	1·85	1351	22·3
·075	19	1·8	9·0	48·4	431	13·5	88	70	33	1·37	16·2	20·7	143	115	1·95	1578	24·6
·100	19	2·08	10·4	64·5	575	14·9	98	79	31	1·63	18·2	22·7	159	127	2·05	1812	26·8
·125	19	2·33	11·7	80·64	718	16·2	108	87	29	1·89	20·0	24·5	173	138	2·15	2047	28·8
·150	19	2·54	12·7	96·77	862	17·2	116	93	28	2·1	21·4	25·9	184	147	2·20	2208	30·3
·175	19	2·75	13·8	112·9	1006	18·3	125	100	27	2·31	22·9	27·4	196	156	2·25	2383	31·9
·200	19	2·94	14·7	129·03	1150	19·2	132	105	26	2·52	24·2	28·7	206	165	2·35	2606	33·4
·225	19	3·12	15·6	145·18	1293	20·1	139	111	26	2·67	25·4	29·9	215	172	2·40	2769	34·7
·250	19	3·29	16·5	161·25	1436	21·0	146	117	25	2·87	26·7	31·2	225	180	2·45	2945	36·1
·275	19	3·45	17·3	177·42	1580	21·8	152	122	25	3·01	27·8	32·3	234	187	2·50	3108	37·3
·300	19	3·6	18·0	193·52	1724	22·5	157	126	24	3·21	28·9	33·4	242	194	2·55	3274	38·5
·325	19	3·75	18·8	209·7	1868	23·3	164	131	24	3·34	30·0	34·5	251	201	2·65	3516	39·8
·350	19	3·89	19·5	225·9	2013	24·0	169	135	24	3·47	30·9	35·4	258	206	2·65	3602	40·7
·375	19	4·03	20·2	241·9	2156	24·7	175	140	24	3·59	31·9	36·4	266	212	2·70	3771	41·8
·400	19	4·15	20·8	258·1	2299	25·3	179	143	23	3·78	32·9	37·4	273	219	2·75	3944	42·9
·425	37	3·07	21·5	274·2	2443	26·0	185	148	23	3·9	33·8	38·3	280	224	2·80	4111	43·9
·450	37	3·16	22·1	290·4	2587	26·6	189	151	23	4·01	34·6	39·1	287	229	2·85	4270	44·8
·475	37	3·25	22·8	306·5	2731	27·3	195	156	23	4·12	35·5	40·0	293	235	2·90	4444	45·8
·500	37	3·33	23·3	322·6	2875	27·8	199	159	23	4·23	36·3	40·8	300	240	2·95	4610	46·7

TABLE No. 147.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·25 mm. (= 88·5 mils). (Weights given in kilog. per km. Dimensions in mm.)—*continued.*

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand	Area of Conductor, sq. mm	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead
	No.	Diam.							No. of Wires	Diam. of Wires					Thickness	Weight	
0·525	37	3·42	23·9	338·8	3019	28·4	203	163	23	4·33	37·1	41·6	306	245	3·00	4779	47·6
·550	37	3·5	24·5	354·9	3163	29·0	208	166	23	4·59	38·2	42·7	315	252	3·05	4984	48·8
·575	37	3·57	25·0	371·0	3306	29·5	212	169	22	4·64	38·8	43·3	319	255	3·05	5050	49·4
·600	37	3·65	25·6	387·2	3450	30·1	217	173	22	4·74	39·6	44·1	325	260	3·10	5226	50·3
·625	37	3·73	26·1	403·3	3594	30·6	220	176	22	4·83	40·3	44·8	331	265	3·15	5395	51·1
·650	37	3·8	26·6	419·4	3738	31·1	224	179	22	4·93	41·0	45·5	336	269	3·20	5567	51·9
·675	37	3·87	27·1	435·5	3881	31·6	228	183	22	5·02	41·6	46·1	341	273	3·20	5635	52·5
·700	37	3·94	27·6	451·7	4025	32·1	232	186	22	5·12	42·3	46·8	346	277	3·25	5810	53·3
·725	37	4·01	28·1	467·8	4169	32·6	236	189	22	5·21	43·0	47·5	352	281	3·30	5988	54·1
·750	37	4·08	28·6	484·0	4313	33·1	240	192	22	5·3	43·7	48·2	357	286	3·30	6071	54·8
·775	37	4·15	29·1	500·0	4457	33·6	244	195	22	5·38	44·4	48·9	363	290	3·35	6252	55·6
·800	37	4·22	29·5	516·2	4601	34·0	247	197	22	5·47	44·9	49·4	367	293	3·35	6312	56·1
·825	61	3·34	30·1	532·3	4744	34·6	252	201	22	5·55	45·7	50·2	373	298	3·40	6510	57·0
·850	61	3·39	30·5	548·5	4889	35·0	255	204	22	5·64	46·3	50·8	377	302	3·45	6684	57·7
·875	61	3·44	31·0	564·6	5033	35·5	259	207	22	5·72	46·9	51·4	382	306	3·45	6759	58·3
·900	61	3·48	31·3	580·7	5176	35·8	261	209	21	5·94	47·7	52·2	388	311	3·50	6963	59·2
·925	61	3·53	31·8	596·8	5319	36·3	265	212	21	6·02	48·3	52·8	393	314	3·55	7145	59·9
·950	61	3·58	32·2	613·0	5463	36·7	268	214	21	6·10	48·9	53·4	398	318	3·55	7222	60·5
·975	61	3·63	32·7	629·1	5607	37·2	272	217	21	6·18	49·6	54·1	403	322	3·60	7419	61·3
1·000	61	3·67	33·0	645·1	5750	37·5	274	219	21	6·26	50·0	54·5	406	325	3·60	7470	61·7

TABLE No. 148.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·5 mm. (= 98·5 mils). (Weights given in kilog. per km., and dimensions in mm.)

Conductor Section, sq. in.	Conductor Wires No.	Conductor Wires Diam.	Diam. of Strand	Area of Conductor. sq. mm.	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outside Conductor No. of Wires	Outside Conductor Diam. of Wires	Diam. over Conductor	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath Thickness	Lead Sheath Weight	Diam. over Lead
0·025	7	1·71	5·1	16·3	144	10·1	66	53	33	0·8	11·7	16·7	123	98	1·75	1153	20·2
·050	19	1·47	7·4	32·3	287	12·4	86	69	36	1·07	14·5	19·5	147	118	1·9	1452	23·3
·075	19	1·8	9·0	48·4	431	14·0	99	78	35	1·33	16·7	21·7	166	133	2·0	1693	25·7
·100	19	2·08	10·4	64·5	575	15·4	112	89	33	1·58	18·6	23·6	182	146	2·1	1928	27·8
·125	19	2·33	11·7	80·6	718	16·7	123	98	31	1·82	20·3	25·3	197	158	2·15	2108	29·6
·150	19	2·54	12·7	96·8	862	17·7	131	105	29	2·06	21·8	26·8	210	168	2·25	2335	31·3
·175	19	2·75	13·8	112·9	1006	18·8	141	113	28	2·27	23·3	28·3	223	178	2·3	2514	32·9
·200	19	2·94	14·7	129·0	1150	19·7	149	119	28	2·43	24·3	29·3	232	185	2·35	2657	34·0
·225	19	3·12	15·6	145·2	1293	20·6	156	125	27	2·62	25·8	30·8	245	196	2·45	2910	35·7
·250	19	3·29	16·5	161·2	1436	21·5	164	131	27	2·76	27·0	32·0	255	204	2·5	3081	37·0
·275	19	3·45	17·3	177·4	1580	22·3	171	137	27	2·9	28·1	33·1	265	212	2·55	3247	38·2
·300	19	3·6	18·0	193·5	1724	23·0	177	142	25	3·14	29·3	34·3	275	220	2·6	3427	39·5
·325	19	3·75	18·8	209·7	1868	23·8	184	147	25	3·27	30·3	35·3	284	227	2·65	3592	40·6
·350	19	3·89	19·5	225·9	2013	24·5	190	152	25	3·39	31·3	36·3	292	234	2·7	3761	41·7
·375	19	4·03	20·2	241·9	2156	25·2	196	157	24	3·59	32·4	37·4	302	241	2·75	3944	42·9
·400	19	4·15	20·8	258·1	2299	25·8	201	161	24	3·7	33·2	38·2	309	247	2·8	4101	43·8
·425	37	3·07	21·5	274·2	2443	26·5	207	166	24	3·82	34·1	39·1	316	253	2·85	4270	44·8
·450	37	3·16	22·1	290·4	2587	27·1	213	170	24	3·93	35·0	40·0	324	259	2·9	4444	45·8
·475	37	3·25	22·8	306·5	2731	27·8	219	175	24	4·03	35·9	40·9	332	265	2·95	4621	46·8
·500	37	3·33	23·3	322·6	2875	28·3	223	178	24	4·14	36·6	41·6	338	270	3·0	4779	47·6

TABLE No. 148—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·5 mm. (= 98·5 mils). (Weights given in kilog. per km., and dimensions in mm.)—*continued.*

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outside Conductor		Diam. over Conductor	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead
	No.	Diam.							No. of Wires	Diam. of Wires					Thickness	Weight	
0·525	37	3·42	23·9	338·8	3019	28·9	228	183	24	4·24	37·4	42·4	345	276	3·0	4865	48·4
·550	37	3·5	24·5	354·9	3163	29·5	233	187	24	4·34	38·2	43·2	352	282	3·05	5039	49·3
·575	37	3·57	25·0	371·0	3306	30·0	238	190	24	4·44	38·9	43·9	358	286	3·1	5204	50·1
·600	37	3·65	25·6	387·1	3450	30·6	243	194	23	4·63	39·9	44·9	367	293	3·15	5406	51·2
·625	37	3·73	26·1	403·3	3594	31·1	247	198	23	4·73	40·6	45·6	373	298	3·2	5578	52·0
·650	37	3·8	26·6	419·4	3738	31·6	251	201	23	4·82	41·2	46·2	378	302	3·2	5647	52·6
·675	37	3·87	27·1	435·5	3881	32·1	256	205	23	4·91	41·9	46·9	381	307	3·25	5822	53·4
·700	37	3·94	27·6	451·6	4025	32·6	260	208	23	5·0	42·6	47·6	390	312	3·3	6000	54·2
·725	37	4·01	28·1	467·8	4169	33·1	265	212	23	5·09	43·3	48·3	396	317	3·3	6082	54·9
·750	37	4·08	28·6	484·0	4313	33·6	269	215	23	5·18	44·0	49·0	402	321	3·35	6264	55·7
·775	37	4·15	29·1	500·0	4457	34·1	273	218	22	5·38	44·9	49·9	410	328	3·4	6473	56·7
·800	37	4·22	29·5	516·2	4601	34·5	277	221	22	5·46	45·4	50·4	414	331	3·4	6534	57·2
·825	61	3·34	30·1	532·3	4744	35·1	282	225	22	5·56	46·2	51·2	421	337	3·45	6733	58·1
·850	61	3·39	30·5	548·5	4889	35·5	285	228	22	5·64	46·8	51·8	426	341	3·5	6914	58·8
·875	61	3·44	31·0	564·6	5033	36·0	290	232	22	5·72	47·4	52·4	431	345	3·5	6988	59·4
·900	61	3·48	31·3	580·7	5176	36·3	292	234	22	5·8	47·9	52·9	436	348	3·55	7156	60·0
·925	61	3·53	31·8	596·8	5319	36·8	297	237	22	5·88	48·6	53·6	442	353	3·6	7354	60·8
·950	61	3·58	32·2	613·0	5463	37·2	300	240	22	5·95	49·1	54·1	446	357	3·6	7419	61·3
·975	61	3·63	32·7	629·1	5607	37·7	304	244	22	6·04	49·8	54·8	452	362	3·65	7620	62·1
1·000	61	3·67	33·0	645·1	5750	38·0	307	245	22	6·11	50·2	55·2	455	364	3·65	7673	62·5

TABLE No. 149.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 3·2 mm. (= 126 mils). (Weights given in kilog. per km., and dimensions in mm.)

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead
	No.	Diam.							No. of Wires	Diam. of Wires					Thickness	Weight	
0·025	7	1·71	5·1	16·3	144	11·5	92	74	33	0·8	13·1	19·5	180	144	1·9	1452	23·3
·050	19	1·47	7·4	32·3	287	13·8	117	94	36	1·07	15·9	22·3	211	169	2·0	1736	26·3
·075	19	1·8	9·0	48·4	431	15·4	135	108	36	1·31	18·0	24·4	234	188	2·1	1988	28·6
·100	19	2·08	10·4	64·5	575	16·8	150	120	36	1·51	19·8	26·2	254	203	2·2	2232	30·6
·125	19	2·33	11·7	80·6	718	18·1	165	132	35	1·71	21·5	27·9	273	219	2·3	2481	32·5
·150	19	2·54	12·7	96·8	862	19·1	176	141	33	1·94	23·0	29·4	290	232	2·35	2665	34·1
·175	19	2·75	13·8	112·9	1006	20·2	188	150	32	2·12	24·4	30·8	305	244	2·45	2910	35·7
·200	19	2·94	14·7	129·0	1150	21·1	198	158	31	2·3	25·7	32·1	320	256	2·5	3090	37·1
·225	19	3·12	15·6	145·2	1293	22·0	208	166	30	2·49	27·0	33·4	334	267	2·55	3274	38·5
·250	19	3·29	16·5	161·3	1436	22·9	218	174	29	2·66	28·2	34·6	347	278	2·65	3526	39·9
·275	19	3·45	17·3	177·4	1580	23·7	227	181	29	2·79	29·3	35·7	359	288	2·7	3703	41·1
·300	19	3·60	18·0	193·5	1724	24·4	234	188	28	2·97	30·3	36·7	371	296	2·75	3875	42·2
·325	19	3·75	18·8	209·7	1868	25·2	243	195	28	3·09	31·4	37·8	383	306	2·8	4061	43·4
·350	19	3·89	19·5	225·9	2013	25·9	251	201	27	3·27	32·4	38·8	394	315	2·85	4240	44·5
·375	19	4·03	20·2	241·9	2156	26·6	259	207	27	3·38	33·4	39·8	405	324	2·9	4423	45·6
·400	19	4·15	20·8	258·1	2299	27·2	265	212	26	3·56	34·3	40·7	415	332	2·95	4599	46·6
·425	37	3·07	21·5	274·2	2443	27·9	273	219	26	3·67	35·2	41·6	425	340	3·0	4779	47·6
·450	37	3·16	22·1	290·4	2587	28·5	280	224	26	3·77	36·0	42·4	434	347	3·0	4865	48·4
·475	37	3·25	22·8	306·5	2731	29·2	287	230	26	3·88	37·0	43·4	444	356	3·05	5060	49·5
·500	37	3·33	23·3	322·6	2875	29·7	293	234	25	4·06	37·8	44·2	453	363	3·1	5238	50·4

TABLE No. 149.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 3·2 mm. (= 126 mils). (Weights given in kilog. per km., and dimensions in mm.)—*continued.*

Conductor Section, sq. in.	Conductor Wires		Diam. of Strand	Area of Conductor, sq. mm.	Copper, weight	Diam. over Paper	Paper, weight	Impregnating Compound, weight	Outer Conductor		Diam. over Conductor	Diam. of Paper	Paper, weight	Impregnating Compound, weight	Lead Sheath		Diam. over Lead
	No.	Diam.							No. of Wires	Diam. of Wires					Thickness	Weight	
0·525	37	3·42	23·9	338·8	3019	30·3	300	240	25	4·16	38·6	45·0	462	370	3·15	5418	51·3
·550	37	3·50	24·5	354·9	3163	30·9	306	245	24	4·39	39·7	46·1	474	379	3·2	5635	52·5
·575	37	3·57	25·0	371·0	3306	31·4	312	249	21	4·44	40·3	46·7	481	385	3·25	5799	53·2
·600	37	3·65	25·6	387·1	3450	32·0	318	255	24	4·54	41·1	47·5	490	392	3·30	5988	54·1
·625	37	3·73	26·1	403·3	3594	32·5	324	259	21	4·63	41·8	48·2	498	398	3·3	6071	51·8
·650	37	3·80	26·6	419·4	3738	33·0	330	261	24	4·72	42·4	48·8	501	403	3·35	6240	55·5
·675	37	3·87	27·1	435·5	3881	33·5	335	268	21	4·81	43·1	49·5	512	410	3·4	6424	56·3
·700	37	3·94	27·6	451·6	4025	34·0	341	272	24	4·90	43·8	50·2	520	416	3·4	6510	57·0
·725	37	4·01	28·1	467·8	4169	34·5	346	277	24	4·98	44·5	50·9	527	422	3·45	6698	57·8
·750	37	4·08	28·6	484·0	4313	35·0	352	281	24	5·07	45·1	51·5	531	427	3·45	6771	58·4
·775	37	4·15	29·1	500·0	4457	35·5	357	286	24	5·15	45·8	52·2	542	434	3·5	6962	59·2
·800	37	4·22	29·5	516·2	4601	35·9	362	289	24	5·24	46·4	52·8	549	439	3·55	7144	59·9
·825	61	3·34	30·1	532·3	4744	36·5	368	295	23	5·43	47·4	53·8	560	448	3·6	7381	61·0
·850	61	3·39	30·5	548·5	4889	36·9	373	298	23	5·51	47·9	54·3	565	452	3·6	7445	61·5
·875	61	3·44	31·0	564·6	5033	37·4	378	303	23	5·59	48·6	55·0	573	458	3·65	7646	62·3
·900	61	3·48	31·3	580·7	5176	37·7	381	305	23	5·67	49·0	55·4	577	462	3·65	7698	62·7
·925	61	3·53	31·8	596·8	5319	38·2	387	310	23	5·75	49·7	56·1	585	468	3·7	7902	63·5
·950	61	3·58	32·2	613·0	5463	38·6	391	313	23	5·83	50·3	56·7	592	474	3·7	7982	64·1
·975	61	3·63	32·7	629·1	5607	39·1	397	318	23	5·90	50·9	57·3	598	478	3·75	8176	64·8
1·000	61	3·67	33·0	645·1	5750	39·4	400	320	23	5·98	51·4	57·8	604	483	3·8	8360	65·4

TABLE No. 150.—CONSTRUCTIONAL DATA AND WEIGHTS OF TRIPLE CONCENTRIC, PAPER INSULATED, LEAD-CASED CABLE. Thickness of Paper Insulation = 2·0 mm. (= 79 mils). (Dimensions given in mm., and weights in kilog. per km.)

Conductor L.S.W.G.	Diam. of each Wire	Conductor Diam. over	Conductor Area, sq. mm.	Copper, weight	Paper Diam. over	Paper Weight	Impregnating Compound, weight	Middle Conductor No. of Wires	Middle Conductor Diam. of Wires	Diam. over Conductor	Paper Diam. over	Paper Weight	Impregnating Compound, weight	Outer Conductor No. of Wires	Outer Conductor Diam. of Wires	Diam. over Conductor	Paper Diam. over	Paper Weight	Impregnating Compound, weight	Lead Sheath Thickness	Lead Sheath Weight	Diam. over Lead
7/20	0·914	2·7	4·59	40·9	6·7	32	26	10	0·8	8·3	12·3	71	57	10	0·8	13·9	17·9	110	88	1·8	1266	21·5
7/19	1·02	3·1	5·72	51·0	7·1	35	28	12	0·8	8·7	12·7	74	59	12	0·8	14·3	18·3	113	90	1·8	1292	21·9
7/18	1·22	3·7	8·18	72·9	7·7	39	31	16	0·8	9·3	13·3	78	63	16	0·8	14·9	18·9	117	94	1·85	1371	22·6
7/17	1·42	4·3	11·09	98·8	8·3	44	35	22	0·8	9·9	13·9	82	66	22	0·8	15·5	19·5	121	97	1·9	1452	23·3
7/16	1·63	4·9	14·61	130	8·9	48	38	29	0·8	10·5	14·5	86	69	29	0·8	16·1	20·1	125	100	1·9	1493	23·9
7/15	1·83	5·5	18·40	164	9·5	52	42	36	0·8	11·1	15·1	90	72	36	0·8	16·7	20·7	129	103	1·95	1578	24·6
7/14	2·03	6·1	22·66	202	10·1	56	45	29	1·0	12·1	16·1	97	78	29	1·0	18·1	22·1	139	111	2·0	1722	26·1
19/20	0·914	4·6	12·47	111	8·6	46	37	25	0·8	10·2	14·2	84	68	25	0·8	15·8	19·8	123	98	1·9	1473	23·6
19/19	1·02	5·1	15·53	138	9·1	49	43	31	0·8	10·7	14·7	88	70	31	0·8	16·3	20·3	127	101	1·9	1507	24·1
19/18	1·22	6·1	22·21	197	10·1	56	45	28	1·0	12·1	16·1	97	78	28	1·0	18·1	22·1	139	111	2·0	1722	26·1
19/17	1·42	7·1	30·09	268	11·1	63	50	35	1·04	13·2	17·2	105	84	35	1·04	19·3	23·3	147	118	2·05	1856	27·4
19/16	1·63	8·2	39·65	353	12·2	71	57	33	1·24	14·7	18·7	116	93	33	1·24	21·2	25·2	160	128	2·15	2100	29·5
19/15	1·83	9·2	49·98	445	13·2	78	62	31	1·43	16·1	20·1	124	100	31	1·42	22·8	26·8	171	137	2·25	2335	31·3
19/14	2·03	10·2	61·49	548	14·2	84	67	30	1·62	17·4	21·4	134	107	30	1·62	24·6	28·6	184	147	2·35	2598	33·3
19/13	2·34	11·7	81·71	728	15·7	95	76	28	1·92	19·5	23·5	149	119	28	1·92	27·3	31·3	203	162	2·45	2953	36·2
19/12	2·64	13·2	104·0	927	17·2	105	84	27	2·23	21·7	25·7	164	131	27	2·23	30·2	34·2	223	178	2·6	3418	39·4
37/16	1·63	11·4	77·2	688	15·4	93	74	29	1·86	19·1	23·1	146	117	29	1·86	26·8	30·8	199	159	2·45	2910	35·7
37/15	1·83	12·8	97·3	867	16·8	102	82	27	2·14	21·1	25·1	160	128	27	2·14	29·4	33·4	217	174	2·55	3274	38·5
37/14	2·03	14·2	119·8	1067	18·2	112	90	26	2·42	23·0	27·0	173	138	26	2·42	31·8	35·8	234	187	2·7	3713	41·2
61/16	1·63	14·7	127·3	1135	18·7	116	93	26	2·5	23·7	27·7	178	142	26	2·5	32·9	36·9	241	193	2·75	3895	42·4
61/15	1·83	16·5	160·4	1430	20·5	128	102	25	2·86	26·2	30·2	195	156	36	2·39	35·0	39·0	256	205	2·85	4260	44·7
61/14	2·03	18·3	197·4	1759	22·3	140	112	24	3·23	28·8	32·8	213	171	36	2·64	38·1	42·1	277	222	3·0	4833	48·1
91/14	2·03	22·3	294·5	2625	26·3	168	134	23	4·05	34·4	38·4	253	201	36	3·23	44·9	48·9	324	259	3·35	6252	55·6
91/13	2·34	25·7	391·3	3487	29·7	192	153	22	4·74	39·2	43·2	285	228	36	3·72	50·6	54·6	364	291	3·6	7482	61·8
91/12	2·64	29·0	498·1	4439	33·0	215	172	21	5·46	43·9	47·9	317	254	36	4·2	56·3	60·3	403	322	3·9	8942	68·1
127/14	2·03	26·4	411·0	3663	30·4	196	157	19	5·25	40·9	44·9	297	237	36	3·82	52·5	56·5	377	304	3·7	9092	63·9
127/13	2·34	30·4	546·2	4868	34·4	224	180	22	5·68	45·8	49·8	330	264	36	4·4	58·6	62·6	419	335	4·0	9514	70·6
127/12	2·64	34·3	695·2	6196	38·3	251	201	21	6·47	51·2	55·2	368	294	36	4·96	65·1	69·1	464	371	4·35	11410	77·8

TABLE No. 151.—CONSTRUCTIONAL DATA AND WEIGHTS OF
Thickness of Paper Insulation = 2·0 mm. (= 79 mils).

Conductor Area		Conductor Strand		Diam. over Conductor	Copper, weight	Paper		Impregnating Compound, weight	Middle Conductor		Diam. over Conductor	Paper	
Sq. inch	Sq. mm.	No. of Wires	Diam. of Wires			Diam. Over	Weight		No. of Wires	Diam. of Wires		Diam. over	Weight
0·025	16·3	7	1·71	5·1	144	9·1	49	39	33	0·8	10·7	14·7	88
·050	32·3	19	1·47	7·4	287	11·4	65	52	35	1·09	13·6	17·6	108
·075	48·4	19	1·8	9·0	431	13·0	76	61	31	1·41	15·8	19·8	123
·100	64·5	19	2·08	10·4	575	14·4	86	69	29	1·69	17·8	21·8	137
·125	80·6	19	2·33	11·7	718	15·7	95	76	28	1·92	19·5	23·5	149
·150	96·8	19	2·54	12·7	862	16·7	102	81	27	2·14	21·0	25·0	159
·175	112·9	19	2·75	13·8	1006	17·8	109	87	26	2·36	22·5	26·5	169
·200	129·0	19	2·94	14·7	1150	18·7	116	93	25	2·57	23·8	27·8	178
·225	145·2	19	3·12	15·6	1293	19·6	122	97	25	2·72	25·0	29·0	187
·250	161·25	19	3·29	16·5	1436	20·5	128	102	24	2·93	26·4	30·4	196
·275	177·4	19	3·45	17·3	1580	21·3	133	107	24	3·07	27·4	31·4	203
·300	193·5	19	3·6	18·0	1724	22·0	138	111	24	3·21	28·4	32·4	210
·325	209·7	19	3·75	18·8	1868	22·8	144	115	24	3·34	29·5	33·5	218
·350	225·9	19	3·89	19·5	2013	23·5	149	119	23	3·54	30·6	34·6	226
·375	241·9	19	4·03	20·2	2156	24·2	154	123	23	3·66	31·5	35·5	232
·400	258·1	19	4·15	20·8	2299	24·8	158	126	23	3·78	32·4	36·4	238
·425	274·2	37	3·07	21·5	2443	25·5	162	130	23	3·9	33·3	37·3	244
·450	290·4	37	3·16	22·1	2587	26·1	167	133	22	4·1	34·3	38·3	251
·475	306·5	37	3·25	22·8	2731	26·8	171	137	22	4·21	35·2	39·2	257
·500	322·6	37	3·33	23·3	2875	27·3	175	140	22	4·32	35·9	39·9	262
·525	338·8	37	3·42	23·9	3019	27·9	179	143	22	4·43	36·7	40·7	268
·550	354·9	37	3·5	24·5	3163	28·5	183	147	22	4·54	37·6	41·6	274
·575	371·0	37	3·57	25·0	3306	29·0	187	149	22	4·63	38·3	42·3	279
·600	387·1	37	3·65	25·6	3450	29·6	191	153	22	4·74	39·1	43·1	284
·625	403·3	37	3·73	26·1	3594	30·1	194	155	22	4·83	39·8	43·8	289
·650	419·4	37	3·8	26·6	3738	30·6	198	158	22	4·93	40·5	44·5	294
·675	435·5	37	3·87	27·1	3881	31·1	201	161	22	5·02	41·1	45·1	298
·700	451·6	37	3·94	27·6	4025	31·6	205	164	22	5·12	41·8	45·8	303
·725	467·8	37	4·01	28·1	4169	32·1	208	167	21	5·33	42·8	46·8	310
·750	484·0	37	4·08	28·6	4313	32·6	212	169	21	5·42	43·4	47·4	314
·775	500·0	37	4·15	29·1	4457	33·1	215	172	21	5·51	44·1	48·1	319
·800	516·2	37	4·22	29·5	4601	33·5	218	175	21	5·6	44·7	48·7	323
·825	532·3	61	3·34	30·1	4744	34·1	222	178	21	5·69	45·5	49·5	328
·850	548·4	61	3·39	30·5	4889	34·5	225	180	21	5·77	46·0	50·0	332
·875	564·6	61	3·44	31·0	5033	35·0	229	183	21	5·88	46·8	50·8	337
·900	580·7	61	3·48	31·3	5176	35·3	230	184	21	5·94	47·2	51·2	340
·925	596·8	61	3·53	31·8	5319	35·8	234	187	21	6·02	47·8	51·8	344
·950	613·0	61	3·58	32·2	5463	36·2	236	189	21	6·10	48·2	52·2	347
·975	629·1	61	3·63	32·7	5607	36·7	240	192	21	6·18	49·1	53·1	353
1·000	645·1	61	3·67	33·0	5750	37·0	242	194	21	6·26	49·5	53·5	356

Triple Concentric, Paper Insulated, Lead-Cased Cable.
(Dimensions given in mm., and weights in kilog. per km.)

Impregnating Compound, weight	Outer Conductor: No. of Wires	Outer Conductor: Diam. of Wires	Diam. over Conductor	Paper: Diam. Over	Paper: Weight	Impregnating Compound, weight	Lead Sheath: Thickness	Lead Sheath: Weight	Diam. over Lead	Conductor Area: Sq. inch	Conductor Area: Sq. mm.
70	33	0·8	16·3	20·3	127	101	1·9	1507	24·1	0·025	16·3
86	35	1·09	19·8	23·8	151	121	2·1	1943	28·0	·050	32·3
98	31	1·41	22·6	26·6	170	136	2·25	2319	31·1	·075	48·4
109	29	1·69	25·2	29·2	188	150	2·35	2648	33·9	·100	64·5
119	28	1·92	27·3	31·3	203	162	2·45	2953	36·2	·125	80·6
127	27	2·14	29·3	33·3	217	173	2·55	3265	38·4	·150	96·8
136	26	2·36	31·2	35·2	230	184	2·65	3583	40·5	·175	112·9
143	36	2·14	32·1	36·1	236	189	2·7	3742	41·5	·200	129·0
149	36	2·27	33·5	37·5	245	196	2·8	4031	43·1	·225	145·2
157	36	2·39	35·2	39·2	257	206	2·85	4281	44·9	·250	161·25
163	36	2·51	36·4	40·4	265	212	2·9	4485	46·2	·275	177·4
168	36	2·62	37·6	41·6	274	219	3·0	4779	47·6	·300	193·5
175	36	2·73	39·0	43·0	283	227	3·05	5017	49·1	·325	209·7
181	36	2·89	40·4	44·4	293	235	3·1	5260	50·6	·350	225·9
185	36	2·93	41·4	45·4	300	240	3·15	5463	51·7	·375	241·9
190	36	3·02	42·4	46·4	307	246	3·2	5669	52·8	·400	258·1
195	36	3·12	43·5	47·5	315	252	3·3	5988	54·1	·425	274·2
201	36	3·21	44·7	48·7	323	258	3·35	6228	55·4	·450	290·4
206	36	3·3	45·8	49·8	330	264	3·4	6461	56·6	·475	306·5
210	36	3·38	46·7	50·7	337	269	3·4	6570	57·5	·500	322·6
214	36	3·47	47·6	51·6	343	274	3·5	6888	58·6	·525	338·8
219	36	3·54	48·7	52·7	351	280	3·5	7026	59·7	·550	354·9
223	36	3·63	49·6	53·6	357	285	3·6	7354	60·8	·575	371·0
227	36	3·7	50·5	54·5	363	290	3·6	7470	61·7	·600	387·1
231	36	3·78	51·4	55·4	369	295	3·65	7698	62·7	·625	403·3
235	36	3·85	52·2	56·2	375	300	3·7	7916	63·6	·650	419·4
238	36	3·93	53·0	57·0	380	304	3·75	8136	64·5	·675	435·5
242	36	4·0	53·8	57·8	386	309	3·8	8361	65·4	·700	451·6
248	36	4·06	54·9	58·9	393	314	..	..	..	·725	467·8
251	36	4·14	55·7	59·7	399	319	..	..	..	·750	484·0
255	36	4·2	56·5	60·5	404	323	..	..	..	·775	500·0
258	36	4·27	57·2	61·2	409	327	..	..	..	·800	516·2
263	36	4·34	58·2	62·2	416	333	..	..	..	·825	532·3
266	36	4·4	58·8	62·8	420	336	..	..	..	·850	548·4
270	36	4·47	59·7	63·7	426	341	..	..	..	·875	564·6
272	36	4·53	60·3	64·3	431	345	..	..	..	·900	580·7
276	36	4·59	61·0	65·0	435	348	..	..	..	·925	596·8
278	36	4·66	61·5	65·5	439	351	..	..	..	·950	613·0
283	36	4·72	62·5	66·5	446	357	..	..	..	·975	629·1
285	36	4·78	63·1	67·1	450	360	..	..	..	1·000	645·1

TABLE No. 152.—CONSTRUCTION DATA AND PRICES OF SINGLE
Thicknesses according to the Rules of

Based on: Copper at £60 per ton; Lead at £1 4*s.* per 100 kilog.;

Area of Conductor in		Number and Size of Wires in Strand			Diameter over Strand in mm.	Copper		Thickness of Dielectric		Diam. over Dielectric in mm.	Paper		Impregnating Compound	
sq. in.	sq. mm.	No. of Wires	Diam. of Wires inch	mm.		Weight, kilog. per km.	Price, Shillings per km.	inch	mm.		Weight, kilog. per km.	Price, Shillings per km.	Weight, kilog. per km.	Price, Shillings per km.
0·025	16·13	7	·067	1·71	5·1	144	184	0·08	2·0	9·1	49	20	39	16
·050	32·26	19	·058	1·47	7·4	287	367	·08	2·0	11·4	65	26	52	21
·075	48·39	19	·071	1·80	9·0	431	552	·08	2·0	13·0	76	30	61	24
·100	64·52	19	·082	2·08	10·4	575	736	·09	2·3	15·0	101	40	81	32
·125	80·64	19	·091	2·32	11·6	718	919	·09	2·3	16·2	111	44	89	36
·150	96·77	37	·072	1·83	12·8	862	1103	·09	2·3	17·4	120	48	96	38
·200	129	37	·083	2·11	14·8	1150	1472	·09	2·3	19·4	136	54	109	44
·250	161	37	·093	2·35	16·5	1436	1838	·10	2·55	21·6	168	67	134	54
·300	193	37	·102	2·58	18·1	1724	2207	·10	2·55	23·2	182	73	146	58
·350	226	37	·109	2·78	19·5	2013	2577	·10	2·55	24·6	194	78	155	62
·400	258	61	·091	2·32	20·9	2299	2943	·10	2·55	26·0	207	83	166	66
·500	323	61	·192	2·59	23·3	2875	3680	·10	2·55	28·4	228	91	182	73
·600	387	91	·091	2·32	25·5	3450	4416	·11	2·8	31·1	274	110	219	88
·700	452	91	·099	2·51	27·6	4025	5152	·11	2·8	33·2	294	118	235	94
·750	484	91	·102	2·60	28·6	4313	5521	·11	2·8	34·2	304	122	243	97
·800	516	91	·106	2·68	29·5	4601	5889	·12	3·05	35·6	343	137	274	110
·900	581	91	·112	2·85	31·4	5176	6625	·12	3·05	37·5	363	145	290	116
1·00	645	91	·118	3·0	33·0	5750	7360	·13	3·3	39·6	414	166	331	132

Conductor, Low Tension, Paper Insulated, Lead-covered Cables.
the Cable Makers' Association.
Paper and Impregnating Compound at £2 per 100 kilog.

Thickness of Lead		Diam. over Lead in mm.	Lead		Total Weight of Materials in kilog. per km.	Total Price of Materials in Shillings per km.	Waste of Materials	Wages in Shillings per km.	Shop Expenses, Shillings per km.	Total Price in Shillings		
inch	mm.		Weight, kilog. per km.	Price, Shillings per km.						Per km.	Per 1000 yards	Per Statute Mile
0·06	1·5	12·1	568	136	800	356	9	27	27	419	383	674
·06	1·5	14·6	743	178	1147	592	15	46	46	699	639	1125
·07	1·8	16·6	952	228	1520	834	21	64	64	983	899	1582
·07	1·8	18·6	1081	259	1838	1067	27	82	123	1299	1188	2090
·07	1·8	19·8	1157	278	2075	1277	32	98	147	1554	1421	2501
·08	2·05	21·5	1425	342	2503	1531	38	118	177	1864	1705	3000
·08	2·05	23·5	1572	377	2967	1947	49	150	225	2371	2168	3816
·09	2·3	26·2	1964	471	3702	2430	61	187	327	3005	2748	4836
·09	2·3	27·8	2094	503	4146	2841	71	218	382	3512	3212	5651
·09	2·3	29·2	2211	531	4573	3248	81	250	437	4016	3673	6462
·10	2·55	31·1	2600	624	5272	3716	93	286	501	4596	4203	7396
·10	2·55	33·5	2821	677	6106	4521	113	348	609	5591	5113	8997
·11	2·8	36·7	3391	814	7334	5428	136	417	834	6815	6232	10970
·11	2·8	38·8	3599	864	8153	6228	156	479	958	7821	7152	12590
·11	2·8	39·8	3699	888	8559	6628	166	510	1020	8324	7612	13400
·12	3·05	41·7	4213	1011	9431	7147	179	550	1100	8976	8208	14450
·12	3·05	43·6	4414	1059	10243	7945	199	611	1222	9977	9123	16060
·12	3·05	45·7	4648	1116	11143	8774	219	674	1348	11015	10073	17730

TABLE NO. 153. CONSTRUCTION DATA AND PRICES OF CONCENTRIC, LOW TENSION, the Cable Makers' Association. *Based on:* Copper at £60 per ton; Lead at

Area of each Conductor		Conductor	No. and Diam. of Wires			Diam. over Conductor in mm.	Copper		Thickness of Paper		Diam. over Paper in mm.	Paper	
sq. in.	sq. mm.		No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.
0·025	16·13	inner	7	·067	1·71	5·1	144	184	·08	2·0	9·1	49	20
		outer	32	·031	0·8	10·7	144	187	·08	2·0	14·7	88	35
·050	32·26	inner	19	·058	1·47	7·4	287	367	·08	2·0	11·4	65	26
		outer	35	·043	1·08	13·6	287	373	·08	2·0	17·6	108	43
·075	48·39	inner	19	·071	1·80	9·0	431	552	·08	2·0	13·0	76	30
		outer	31	·056	1·41	15·8	431	552	·08	2·0	19·8	123	49
·100	64·52	inner	19	·082	2·08	10·4	575	736	·09	2·3	15	101	40
		outer	31	·064	1·63	18·5	575	736	·09	2·3	22·9	164	66
·125	80·64	inner	19	·091	2·32	11·6	718	919	·09	2·3	16·2	111	44
		outer	29	·074	1·88	20·0	718	919	·09	2·3	24·6	177	71
·150	96·77	inner	37	·072	1·83	12·8	862	1103	·09	2·3	17·4	120	48
		outer	28	·082	2·09	21·6	862	1103	·09	2·3	26·2	190	76
·200	129	inner	37	·083	2·11	14·8	1150	1472	·09	2·3	19·4	136	54
		outer	26	·099	2·51	24·4	1150	1472	·09	2·3	29·0	212	85
·250	161	inner	37	·093	2·35	16·5	1436	1838	·10	2·55	21·6	168	67
		outer	27	·109	2·76	27·1	1436	1838	·10	2·55	32·2	261	104
·300	193·5	inner	37	·102	2·58	18·1	1724	2207	·10	2·55	23·2	182	73
		outer	26	·121	3·08	29·4	1724	2207	·10	2·55	34·5	282	113
·350	226	inner	37	·109	2·78	19·5	2013	2577	·10	2·55	24·6	194	78
		outer	25	·134	3·39	31·4	2013	2577	·10	2·55	36·5	299	120
·400	258	inner	61	·091	2·32	20·9	2299	2943	·10	2·55	26·0	207	83
		outer	25	·143	3·63	33·3	2299	2943	·10	2·55	38·4	316	126
·500	323	inner	61	·102	2·59	23·3	2875	3680	·10	2·55	28·4	228	91
		outer	24	·163	4·14	36·7	2875	3680	·10	2·55	41·8	346	138
·600	387	inner	91	·091	2·32	25·5	3450	4416	·11	2·8	31·1	274	110
		outer	24	·178	4·53	40·2	3450	4416	·11	2·8	45·8	416	166
·700	452	inner	91	·099	2·51	27·6	4025	5152	·11	2·8	33·2	294	118
		outer	23	·197	5·0	43·2	4025	5152	·11	2·8	48·8	445	178
·750	484	inner	91	·102	2·60	28·6	4313	5521	·11	2·8	34·2	304	122
		outer	23	·204	5·18	44·6	4313	5521	·11	2·8	50·2	459	184
·800	516	inner	91	·106	2·68	29·5	4691	5889	·12	3·05	35·6	343	137
		outer	23	·211	5·35	46·3	4601	5889	·12	3·05	52·4	520	208
·900	581	inner	91	·112	2·85	31·4	5176	6625	·12	3·05	37·5	363	145
		outer	23	·223	5·67	48·8	5176	6625	·12	3·05	54·9	546	218
1·00	645	inner	91	·118	3·0	33·0	5750	7360	·13	3·3	39·6	414	166
		outer	23	·236	5·98	51·6	5750	7360	·13	3·3	58·2	626	250

Paper Insulated, Lead-covered Cables. Thicknesses, according to the rules of £1 4s. per 100 kilog.; Paper and Impregnating Compound at £2 per 100 kilog.

Impregnating Compound: Weight, kilog. per km.	Impregnating Compound: Price, shillings per km.	Thickness of Lead: in.	Thickness of Lead: mm.	Diam. over Lead in mm.	Lead: Weight, kilog. per km.	Lead: Price, shillings per km.	Total Weight of Material kilog. per km.	Total Price of Material shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop expenses, shillings per km.	Price in shillings per km.	Price in shillings per 1000 yds.	Price in shillings per statute mile
39	16	..	..	..	..	..	..	..	..	..	..	..	..	..
70	28	·07	1·8	18·3	1061	255	1595	725	18	89	89	921	842	1482
52	21	..	..	..	..	..	..	..	..	..	..	..	..	..
86	34	·08	2·05	21·7	1439	345	2124	1209	30	149	224	1612	1474	2594
61	24	..	..	..	..	..	..	..	..	..	..	..	..	..
98	39	·08	2·05	23·9	1599	384	2819	1630	40	200	300	2170	1985	3492
81	32	..	..	..	..	..	..	..	..	..	..	..	..	..
131	52	·09	2·3	27·5	2070	497	3697	2159	53	265	398	2875	2629	4626
89	36	..	..	..	..	..	..	..	..	..	..	..	..	..
142	57	·09	2·3	29·2	2211	531	4166	2577	65	317	554	3513	3213	5653
96	38	..	..	..	..	..	..	..	..	..	..	..	..	..
152	61	·10	2·55	31·3	2618	628	4900	3057	76	376	658	4167	3811	6706
109	44	..	..	..	..	..	..	..	..	..	..	..	..	..
170	68	·10	2·55	34·1	2874	690	5801	3885	97	478	837	5297	4844	8524
134	54	..	..	..	..	..	..	..	..	..	..	..	..	..
209	84	·11	2·8	37·8	3500	840	7144	4825	120	594	1040	6579	6016	10588
146	58	..	..	..	..	..	..	..	..	..	..	..	..	..
226	90	·11	2·8	40·1	3729	895	8013	5643	140	694	1388	7865	7192	12658
155	62	..	..	..	..	..	..	..	..	..	..	..	..	..
239	96	·12	3·05	42·6	4307	1034	9220	6544	163	805	1610	9122	8342	14680
166	66	..	..	..	..	..	..	..	..	..	..	..	..	..
253	101	·12	3·05	44·5	4518	1084	10058	7346	183	904	1808	10241	9364	16480
182	73	..	..	..	..	..	..	..	..	..	..	..	..	..
277	111	·13	3·3	48·4	5314	1275	12097	9048	225	1113	2226	12612	11533	20296
219	88	..	..	..	..	..	..	..	..	..	..	..	..	..
333	133	·13	3·3	52·4	5786	1389	13928	10718	268	1319	2638	14943	13665	24050
235	94	..	..	..	..	..	..	..	..	..	..	..	..	..
356	142	·14	3·55	55·9	6639	1593	16019	12429	310	1529	3058	17326	15843	27880
243	97	..	..	..	..	..	..	..	..	..	..	..	..	..
367	147	·14	3·55	57·3	6816	1636	16815	13228	330	1627	3254	18439	16860	29670
274	110	..	..	..	..	..	..	..	..	..	..	..	..	..
416	166	·15	3·8	60·0	7630	1831	18385	14230	355	1750	3500	19835	18140	31920
290	116	..	..	..	..	..	..	..	..	..	..	..	..	..
437	175	·15	3·8	62·5	7968	1912	19956	15816	395	1945	3890	22046	20160	35475
331	132	..	..	..	..	..	..	..	..	..	..	..	..	..
501	200	·15	3·8	65·8	8416	2020	21788	17488	438	2151	4302	24379	22290	39230

TABLE No. 154.— CONSTRUCTION DATA AND PRICES OF TRIPLE CONCENTRIC, LOV
THE RULES OF THE CABLE MAKERS' ASSOCIATION. *Based on*: Copper at £6
at £

Area of each Conductor		Conductor	No. and Diam. of Wires			Diam. over Conductor in mm.	Copper		Thickness of Paper		Diam. over Paper in mm.	Paper	
sq. in.	sq. mm.		No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.
0·025	16·13	inner	7	·067	1·71	5·1	144	184	·08	2·0	9·1	49	20
		middle	32	·031	0·8	10·7	144	187	·08	2·0	14·7	88	35
		outer	32	·031	0·8	16·3	144	187	·08	2·0	20·3	126	50
·050	32·26	inner	19	·058	1·47	7·4	287	367	·08	2·0	11·4	65	26
		middle	35	·043	1·08	13·6	287	373	·08	2·0	17·6	108	43
		outer	36	·042	1·07	19·7	287	373	·08	2·0	23·7	150	60
·075	48·4	inner	19	·071	1·80	9·0	431	552	·08	2·0	13·0	76	30
		middle	31	·056	1·41	15·8	431	552	·08	2·0	19·8	123	49
		outer	36	·052	1·31	22·4	431	556	·08	2·0	26·4	168	67
·100	64·5	inner	19	·082	2·08	10·4	575	736	·09	2·3	15·0	101	40
		middle	31	·064	1·63	18·3	575	736	·09	2·3	22·9	164	66
		outer	36	·059	1·51	25·9	575	736	·09	2·3	30·5	224	90
·125	80·6	inner	19	·091	2·32	11·6	718	919	·09	2·3	16·2	111	44
		middle	29	·074	1·88	20·0	718	919	·09	2·3	24·6	177	71
		outer	36	·067	1·69	28·0	718	919	·09	2·3	32·6	241	96
·150	96·8	inner	37	·072	1·83	12·8	862	1103	·09	2·3	17·4	120	48
		middle	28	·082	2·09	21·6	862	1103	·09	2·3	26·2	190	76
		outer	36	·073	1·85	29·9	862	1103	·09	2·3	34·5	256	102
·200	129	inner	37	·083	2·11	14·8	1150	1472	·09	2·3	19·4	136	54
		middle	26	·099	2·51	24·4	1150	1472	·09	2·3	29·0	212	85
		outer	36	·084	2·14	33·3	1150	1472	·09	2·3	37·9	283	113
·250	161	inner	37	·093	2·35	16·5	1436	1838	·10	2·55	21·6	168	67
		middle	27	·109	2·76	27·1	1436	1838	·10	2·55	32·2	261	104
		outer	36	·094	2·39	37·0	1436	1838	·10	2·55	42·1	348	139
·300	193·5	inner	37	·102	2·58	18·1	1724	2207	·10	2·55	23·2	182	73
		middle	26	·121	3·08	29·4	1724	2207	·10	2·55	34·5	282	113
		outer	36	·103	2·62	39·7	1724	2207	·10	2·55	44·8	372	149
·350	226	inner	37	·109	2·78	19·5	2013	2577	·10	2·55	24·6	194	78
		middle	25	·134	3·39	31·4	2013	2577	·10	2·55	36·5	299	120
		outer	36	·111	2·83	42·2	2013	2577	·10	2·55	47·3	394	158
·400	258	inner	61	·091	2·32	20·9	2299	2943	·10	2·55	26·0	207	83
		middle	25	·143	3·63	33·3	2299	2943	·10	2·55	38·4	316	126
		outer	36	·119	3·02	44·4	2299	2943	·10	2·55	49·5	414	166
·500	323	inner	61	·192	2·59	23·3	2875	3680	·10	2·55	28·4	228	91
		middle	24	·163	4·14	36·7	2875	3680	·10	2·55	41·8	346	138
		outer	36	·133	3·38	48·6	2875	3680	·10	2·55	53·7	451	180

TENSION, PAPER INSULATED, LEAD-COVERED CABLES. THICKNESSES ACCORDING TO per ton; Lead at £1 4*s.* per 100 kilog.; Paper and Impregnating Compound per 100 kilog.

Impregnating Compound		Thickness of Lead		Diam. over Lead in mm.	Lead		Total Price of Material shillings per km.	Total Weight of Material kilog. per km.	Waste in shillings per km.	Wages in shillings per km.	Shop Expenses in shillings per km.	Price in shillings per		
Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.						km.	1000 yards	statute mile
39	16	..	..	..	..	..	..	..	..	..	..	..	..	..
70	28	..	..	..	..	..	..	..	..	..	..	..	..	..
101	40	·08	2·05	24·4	1636	393	2541	1140	29	100	100	1369	1252	2203
52	21	..	..	..	..	..	..	..	..	..	..	..	..	..
86	34	..	..	..	..	..	..	..	..	..	..	..	..	..
120	48	·09	2·3	28·3	2136	513	3578	1858	46	120	180	2204	2016	3547
61	24	..	..	..	..	..	..	..	..	..	..	..	..	..
98	39	..	..	..	..	..	..	..	..	..	..	..	..	..
134	54	·10	2·55	31·5	2637	633	4590	2556	64	150	225	2995	2739	4820
81	32	..	..	..	..	..	..	..	..	..	..	..	..	..
131	52	..	..	..	..	..	..	..	..	..	..	..	..	..
179	72	·10	2·55	35·6	3011	723	5616	3283	82	200	350	3915	3580	6300
89	36	..	..	..	..	..	..	..	..	..	..	..	..	..
142	57	..	..	..	..	..	..	..	..	..	..	..	..	..
193	77	·11	2·80	38·2	3540	850	6647	3988	100	240	420	4748	4342	7641
96	38	..	..	..	..	..	..	..	..	..	..	..	..	..
152	61	..	..	..	..	..	..	..	..	..	..	..	..	..
205	82	·11	2·80	40·1	3729	895	7334	4611	115	290	580	5596	5117	9005
109	44	..	..	..	..	..	..	..	..	..	..	..	..	..
170	68	..	..	..	..	..	..	..	..	..	..	..	..	..
226	90	·12	3·05	44·0	4462	1071	9048	5941	149	320	640	7050	6447	11347
134	54	..	..	..	..	..	..	..	..	..	..	..	..	..
209	84	..	..	..	..	..	..	..	..	..	..	..	..	..
278	111	·13	3·3	48·7	5350	1284	11056	7357	184	365	730	8636	7897	13900
146	58	..	..	..	..	..	..	..	..	..	..	..	..	..
226	90	..	..	..	..	..	..	..	..	..	..	..	..	..
298	119	·13	3·3	51·4	5670	1361	12348	8584	215	415	830	10044	9184	16164
155	62	..	..	..	..	..	..	..	..	..	..	..	..	..
239	96	..	..	..	..	..	..	..	..	..	..	..	..	..
315	126	·14	3·55	54·4	6448	1548	14083	9919	248	460	920	11547	10560	18580
166	66	..	..	..	..	..	..	..	..	..	..	..	..	..
253	101	..	..	..	..	..	..	..	..	..	..	..	..	..
331	132	·14	3·55	56·6	6728	1615	15312	11118	278	505	1010	12911	11810	20776
182	73	..	..	..	..	..	..	..	..	..	..	..	..	..
277	111	..	..	..	..	..	..	..	..	..	..	..	..	..
361	144	·15	3·8	61·3	7805	1873	18275	13650	341	600	1200	15791	14440	25410

TABLE No. 156.—CONSTRUCTION DATA AND PRICES OF
for 2200 Volts working with earthed outer. Thicknesses
Based on: Copper at £60 per ton; Lead at £1 4*s*. per 100 kilog.;

Area of Each Conductor		Con-ductor	Number and Diameter of Wires			Diam. over Con-ductor in mm.	Copper		Thickness of Paper		Diam. over Paper in mm.	Paper	
Sq. inch	Sq. mm.		No.	inch	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm		Weight, kilog. per km.	Price, shillings per km.
·025	16·13	inner	7	0·067	1·71	5·1	144	184	0·12	3·05	11·2	86	34
		outer	32	·031	0·08	12·8	144	187	·08	2·05	16·9	105	42
·050	32·26	inner	19	·058	1·47	7·4	287	367	·12	3·05	13·5	110	44
		outer	36	·042	1·07	14·9	287	373	·08	2·05	19·0	120	48
·075	48·4	inner	19	·071	1·80	9·0	431	552	·12	3·05	15·1	127	51
		outer	36	·052	1·31	17·7	431	560	·08	2·05	21·8	140	56
·100	64·5	inner	19	·082	2·08	10·4	575	736	·13	3·3	17·0	156	62
		outer	36	·060	1·52	20·0	575	736	·09	2·3	24·6	177	71
·125	80·6	inner	19	·091	2·32	11·6	718	919	·13	3·3	18·2	170	68
		outer	35	·068	1·72	21·6	718	919	·09	2·3	26·2	190	76
·150	96·8	inner	37	·072	1·83	12·8	862	1103	·13	3·3	19·4	184	74
		outer	33	·076	1·94	23·3	862	1103	·09	2·3	27·9	204	82
·200	129	inner	37	·083	2·11	14·8	1150	1472	·13	3·3	21·4	206	82
		outer	31	·091	2·31	26·0	1150	1472	·09	2·3	30·6	225	90
·250	161	inner	37	·093	2·35	16·5	1436	1838	·14	3·55	23·6	246	98
		outer	30	·103	2·62	28·8	1436	1838	·10	2·55	33·9	276	110

Concentric, Paper Insulated, Lead-covered Cable, according to the Rules of the Cable Makers' Association. Paper and Impregnating Compound at £2 per 100 kilog.

Impregnating Compound		Thickness of Lead		Diameter over Lead in mm.	Lead		Total weight of material kilog. per km.	Total Price of material shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price in shillings per		
Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.						km.	1000 yards	statute mile
69	28	..	..	..	..	..	..	..	..	..	..	..	..	..
84	34	·08	2·05	21·0	1388	333	2020	842	21	140	140	1143	1045	1839
88	35	..	..	..	..	..	..	..	..	..	..	..	..	..
96	38	·09	2·3	23·6	1750	420	2818	1325	33	170	255	1783	1631	2869
102	41	..	..	..	..	..	..	..	..	..	..	..	..	..
112	45	·09	2·3	26·4	1979	475	3322	1780	45	200	300	2325	2126	3741
125	50	..	..	..	..	..	..	..	..	..	..	..	..	..
142	57	·10	2·55	29·7	2473	594	4223	2306	58	230	345	2939	2688	4729
136	54	..	..	..	..	..	..	..	..	..	..	..	..	..
152	61	·10	2·55	31·3	2618	628	4702	2725	68	260	455	3508	3208	5645
147	59	..	..	..	..	..	..	..	..	..	..	.	..	..
163	65	·11	2·8	33·5	3073	738	5495	3224	81	290	508	4103	3752	6602
165	66	..	..	..	..	..	..	..	..	...	..	..	..	..
180	72	·11	2·8	36·2	3342	802	6418	4056	101	350	608	5115	4677	8230
197	79	..	..	..	..	..	..	..	..	..	..	..	..	..
221	88	·12	3·05	40·0	4024	966	7836	5017	125	400	700	6242	5708	10046

Table No. 157.—Construction Data and Prices of Concentric, Working with

Thicknesses according to the Rules

Based on: Copper at £60 per ton; Lead at £1 4s. per 100 kilog.;

Area of each Conductor		Con-ductor	Number and Diameter of Wires			Diameter over Conductor in mm.	Copper		Thickness of Paper		Diameter over Paper in mm.	Paper	
sq. in.	sq. mm.		No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.
0·025	16·13	inner	7	0·067	1·71	5·1	144	184	0·15	3·8	12·7	117	47
		outer	32	·031	0·80	14·3	144	187	·09	2·3	18·9	132	53
·050	32·26	inner	19	·058	1·47	7·4	287	367	·15	3·8	15·0	147	59
		outer	54	·034	0·87	16·7	287	373	·09	2·3	21·3	151	60
·075	48·4	inner	19	·071	1·80	9·0	431	552	·15	3·8	16·6	168	67
		outer	46	·046	1·16	18·9	431	556	·09	2·3	23·5	169	68
·100	64·5	inner	19	·082	2·08	10·4	575	736	·16	4·05	18·5	202	81
		outer	43	·054	1·38	21·3	575	742	·10	2·55	26·4	210	84
·125	80·6	inner	19	·091	2·32	11·6	718	919	·16	4·05	19·7	219	88
		outer	39	·064	1·62	22·9	718	919	·10	2·55	28·0	224	90
·150	96·8	inner	37	·072	1·83	12·8	862	1103	·16	4·05	20·9	236	94
		outer	38	·071	1·80	24·5	862	1103	·11	2·8	30·1	264	106
·200	129	inner	37	·083	2·11	14·8	1150	1472	·16	4·05	22·9	264	106
		outer	34	·087	2·20	27·3	1150	1472	·11	2·8	32·9	291	116
·250	161	inner	37	·093	2·35	16·5	1436	1838	·17	4·3	25·1	309	124
		outer	33	·098	2·49	30·1	1436	1838	·11	2·8	35·7	319	128

Paper Insulated, Lead-covered Cables for 3300 Volts, Earthed Outer.

of the Cable Makers' Association.

Paper and Impregnating Compound at £2 per 100 kilog.

Impregnating Compound		Thickness of Lead		Diameter over Lead in mm.	Lead		Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price, shillings per		
Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.						km.	1000 yds.	Statute mile
94	38	..	..	..	..	..	..	..	..	..	..	..	..	..
106	42	·09	2·3	23·5	1742	418	2479	969	24	170	170	1333	1219	2145
118	47	..	..	..	..	..	..	..	..	..	..	..	..	..
121	48	·10	2·55	26·4	2172	521	3283	1475	37	200	300	2012	1840	3237
134	54	..	..	..	..	..	..	..	..	..	..	..	..	..
135	54	·10	2·55	28·6	2372	569	3840	1920	48	234	351	2553	2335	4108
162	65	..	..	..	..	..	..	..	..	..	..	..	..	..
168	67	·10	2·55	31·5	2637	633	4529	2408	60	266	399	3133	2865	5042
175	70	..	..	..	..	..	..	..	..	..	..	..	..	..
179	72	·11	2·8	33·6	3082	740	5315	2898	72	296	518	3784	3460	6089
189	76	..	..	..	.	..	..	..	..	..	..	..	..	..
211	84	·11	2·8	35·7	3291	790	5915	3356	84	328	574	4342	3971	6987
211	84	..	..	..	..	..	..	..	..	..	..	..	..	..
233	93	·12	3·05	39·0	3914	939	7213	4282	107	388	679	5456	4989	8780
247	99	..	..	..	..	..	..	..	...	..	..	..	..	..
255	102	·13	3·3	42·3	4597	1103	8599	5232	131	450	788	6601	6036	10623

Table No. 158.—Construction Data and Prices of Concentric, Working with

Thicknesses according to the Rules

Based on: Copper at £60 per ton; Lead at £1 4*s*. per 100 kilog.;

Area of each Conductor		Con-ductor	Number and Diameter of Wires			Diam. over Con-ductor in mm.	Copper		Thickness of Paper		Diameter over Paper in mm.	Paper	
sq. in.	sq. mm.		No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.
0·025	16·13	inner	7	0·067	1·71	5·1	144	184	0·23	5·85	16·8	221	88
		outer	32	·031	0·80	18·4	144	187	·10	2·55	23·5	185	74
·050	32·26	inner	19	·058	1·47	7·4	287	367	·23	5·85	19·1	268	107
		outer	64	·031	0·80	20·7	287	373	·10	2·55	25·8	205	82
·075	48·4	inner	19	·071	1·80	9·0	431	552	·23	5·85	20·7	300	120
		outer	68	·037	0·95	22·6	431	560	·10	2·55	27·7	222	89
·100	64·5	inner	19	·082	2·08	10·4	575	736	·24	6·1	22·6	348	139
		outer	61	·046	1·16	24·9	575	742	·11	2·8	30·5	268	107
·125	80·6	inner	19	·091	2·32	11·6	718	919	·24	6·1	23·8	373	149
		outer	55	·054	1·37	26·5	718	926	·11	2·8	32·1	284	114
·150	96·8	inner	37	·072	1·83	12·8	862	1103	·24	6·1	25·0	398	159
		outer	51	·061	1·55	28·1	862	1103	·12	3·05	34·2	328	131
·200	129	inner	37	·083	2·11	14·8	1150	1472	·24	6·1	27·0	441	176
		outer	45	·075	1·91	30·8	1150	1472	·12	3·05	36·9	357	143
·250	161	inner	37	·093	2·35	16·5	1436	1838	·25	6·35	29·2	502	201
		outer	43	·086	2·19	33·6	1436	1838	·12	3·05	39·7	386	154

Paper Insulated, Lead-covered Cable for 6600 Volts, Earthed Outer.

of the Cable Makers' Association.

Paper and Impregnating Compound at £2 per 100 kilog.

Impregnating Compound		Thickness of Lead		Diameter over Lead in mm.	Lead		Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price, shillings per		
Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.						km.	1000 yd.	Statute mile
177	71	..	..	..	..	..	..	..	..	..	..	..	..	..
148	59	·10	2·55	28·6	2372	569	3391	1232	31	210	210	1683	1539	2708
214	86	..	..	..	..	..	..	..	..	..	..	..	..	..
164	66	·11	2·8	31·4	2860	686	4285	1767	44	242	363	2416	2209	3888
240	96	..	..	..	..	..	..	..	..	..	..	..	..	..
178	71	·12	3·05	33·8	3350	804	5152	2292	57	278	417	3044	2784	4898
278	111	..	..	..	..	..	..	..	..	..	..	..	..	..
215	86	·12	3·05	36·6	3658	878	5917	2799	70	310	465	3644	3332	5864
298	119	..	..	..	..	..	..	..	..	..	..	..	..	..
227	91	·13	3·3	38·7	4171	1001	6789	3319	83	345	605	4352	3980	7004
318	127	..	..	..	..	..	..	..	..	..	..	..	..	..
262	105	·13	3·3	40·8	4421	1061	7451	3789	95	380	665	4929	4507	7932
353	141	..	..	..	..	..	..	..	..	..	..	..	..	..
286	114	·13	3·3	43·5	4736	1137	8473	4655	116	428	749	5948	5439	9571
402	161	..	..	..	..	..	..	..	..	..	..	..	..	..
309	124	·14	3·55	46·8	5485	1317	9956	5633	141	515	902	7191	6576	11574

TABLE No. 159.—CONSTRUCTION DATA AND PRICES OF CONCENTRIC, WORKING WITH

Thicknesses according to the Rules

Based on : Copper at £60 per ton ; Lead at £1 4*s.* per 100 kilog. ;

Area of each Conductor		Con-ductor	No. and Diam. of Wires			Diam. over Con-ductor, mm.	Copper		Thickness of Paper		Diam. over Paper, mm.	Paper	
sq. in.	sq. mm.		No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.
0·025	16·13	inner	7	0·067	1·71	5·1	144	184	0·35	8·9	22·9	431	172
		outer	32	·031	0·80	24·5	144	187	·23	5·8	36·1	607	243
·050	32·26	inner	19	·058	1·47	7·4	287	367	·35	8·9	25·2	501	200
		outer	64	·031	0·80	26·8	287	373	·23	5·8	38·4	653	261
·075	48·4	inner	19	·071	1·80	9·0	431	552	·35	8·9	26·8	551	220
		outer	70	·037	0·94	28·7	431	560	·23	5·8	40·3	692	277
·100	64·5	inner	19	·082	2·08	10·4	575	736	·36	9·1	28·6	613	245
		outer	70	·043	1·09	30·8	575	747	·24	6·1	43·0	778	311
·125	80·6	inner	19	·091	2·32	11·6	718	919	·36	9·1	29·8	651	260
		outer	70	·048	1·22	32·3	718	928	·24	6·1	44·5	809	324
·150	96·8	inner	37	·072	1·83	12·8	862	1103	·36	9·1	31·0	689	276
		outer	70	·052	1·33	33·7	862	1114	·24	6·1	45·9	839	336
·200	129	inner	37	·083	2·11	14·8	1150	1472	·36	9·1	33·0	752	301
		outer	65	·063	1·59	36·2	1150	1472	·24	6·1	48·4	892	357
·250	161	inner	37	·093	2·35	16·5	1436	1838	·37	9·4	35·3	842	337
		outer	60	·073	1·85	39·0	1436	1838	·25	6·4	51·8	1004	402

Paper Insulated, Lead-covered Cable for 11,000 Volts, Earthed Outer.

of the Cable Makers' Association.

Paper and Impregnating Compound at £2 per 100 kilog.

Impregnating Compound		Thickness of Lead		Diam. over Lead, mm.	Lead		Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price in shillings per		
Weight, kilog. per km.	Price, shillings per km.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.						km.	1000 yards	Statute mile
345	138	..	..	..	..	..	..	..	..	..	..	..	..	..
486	194	·12	3·05	42·2	4265	1024	6422	2142	54	260	260	2716	2484	4371
401	160	..	..	..	..	..	..	..	..	..	..	..	..	..
522	209	·13	3·3	45·0	4917	1180	7568	2750	69	298	497	3614	3305	5816
441	176	..	..	..	..	..	..	..	..	..	..	..	..	..
554	222	·13	3·3	46·9	5140	1234	8240	3241	81	325	488	4135	3781	6654
490	196	..	..	..	..	..	..	..	..	..	..	..	..	..
622	249	·14	3·55	50·1	5905	1417	9558	3901	98	375	563	4937	4515	7944
521	208	..	..	..	..	..	..	..	..	..	..	..	..	..
647	259	·14	3·55	51·6	6093	1463	10157	4361	109	410	718	5598	5119	9008
551	220	..	..	..	..	..	..	..	..	..	..	..	..	..
671	268	·15	3·8	53·5	6746	1619	11220	4936	123	450	788	6297	5758	10135
602	241	..	..	..	..	..	..	..	..	..	..	..	..	..
714	286	·16	4·05	56·5	7590	1822	12850	5951	149	525	920	7545	6900	12143
674	270	..	..	..	..	..	..	..	..	..	..	..	..	..
803	321	·17	4·3	60·4	8617	2068	14812	7071	177	600	1050	8901	8140	14325

TABLE No. 165.—COMPARISON OF PRICES OF SINGLE CONDUCTOR, LEAD-COVERED AND STEEL TAPE ARMOURED CABLE INSULATED WITH VARIOUS MATERIALS.
(Prices given in shillings.)

Area of Conductor, sq. mm.	For 600 Volts			For 1000 Volts			For 3000 Volts		
	Paper 1·5 mm. thick	Jute 2·0 mm. thick	Jute 0·5 mm., plus Paper 1·0 mm. thick	Paper 2·0 mm. thick	Jute 2·5 mm. thick	Jute 0·5 mm., Paper 1·5 mm. thick	Paper 2·5 mm. thick	Jute 3·0 mm. thick	Jute 0·5 mm., Paper 2·0 mm. thick
10	581	616	572	646	725	627	780	785	752
16	750	783	740	770	867	746	932	943	898
25	881	918	869	963	1043	939	1115	1113	1082
35	1046	1146	1031	1199	1245	1171	1323	1325	1284
50	1366	1405	1347	1463	1502	1430	1588	1588	1542
70	1744	1808	1723	1883	1923	1846	2026	2018	1974
95	2157	2169	2128	2250	2313	2209	2424	2425	2367
120	2527	2572	2497	2665	2722	2620	2843	2820	2778
150	3012	3047	2979	3150	3200	3098	3329	3304	3260
185	3589	3637	3553	3755	3810	3699	3956	3900	3881
210	4003	4014	3964	4139	4197	4080	4348	4285	4266
240	4436	4481	4394	4618	4633	4555	4796	4748	4710
280	5028	5058	4983	5205	5220	5139	5393	5373	5303
310	5494	5470	5443	5646	5696	5578	5888	5824	5796
355	6105	6199	6053	6367	6372	6292	6566	6498	6465
400	6824	6838	6771	7020	7037	6943	7244	7169	7139
500	8242	8301	8185	8509	8519	8422	8753	8633	8635
625	10187	10182	10123	10431	10389	10337	10659	10570	10531
725	11686	11672	11618	11948	11930	11846	12230	12056	12092
800	12750	12750	12677	13046	12999	12940	13317	13159	13173
1000	15575	15607	15493	15952	15829	15834	16192	15967	16032

TABLE No. 166.—CONSTRUCTIONAL DATA FOR TWO-CORE, PAPER AND JUTE INSULATED, LEAD-CASED AND ARMOURED CABLE FOR 600 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Dia. over Conductor, mm.	Dia. over Paper, mm.	Dia. over laid up cores, mm.	Dia. over Jute, mm.	Lead case		Dia. over Jute serving, mm.	Dimensions of Steel Tapes, mm.	Dia. over Steel Tape, mm.	Dia. over Jute serving, mm.	Weight of Cable, kilog. per km.
						thickness, mm.	Dia. over lead, mm.					
10	7×1·35	4·1	7·1	14·2	16·2	1·65	19·5	23·5	25×0·9	27·1	31·1	2980
16	7×1·71	5·1	8·1	16·2	18·2	1·8	21·8	25·8	25×0·9	29·4	33·4	3550
25	7×2·13	6·4	9·4	18·8	20·8	1·95	24·7	28·7	33×0·9	32·3	36·3	4310
35	19×1·53	7·7	10·7	21·4	23·4	2·05	27·5	31·5	33×0·9	35·1	39·1	5070
50	19×1·83	9·2	12·2	24·4	26·4	2·15	30·7	34·7	33×0·9	38·3	42·3	6020
70	19×2·17	10·9	13·9	27·8	29·8	2·3	34·4	38·4	43×1·0	42·4	46·4	7400
95	19×2·53	12·7	15·7	31·4	33·4	2·4	38·2	42·2	43×1·0	46·2	50·2	8760
120	19×2·83	14·2	17·2	34·4	36·4	2·5	41·4	45·4	43×1·0	49·4	53·4	10010
150	19×3·17	15·9	18·9	37·8	39·8	2·65	45·1	49·1	55×1·1	53·5	57·5	11730
185	19×3·52	17·6	20·6	41·2	43·2	2·75	48·7	52·7	55×1·1	57·1	61·1	13350
210	19×3·75	18·8	21·8	43·6	45·6	2·85	51·3	55·3	55×1·1	59·7	63·7	14590
240	19×4·01	20·1	23·1	46·2	48·2	2·9	54·0	58·0	55×1·1	62·4	66·4	15900
280	37×3·1	21·7	24·7	49·4	51·4	3·0	57·4	61·4	55×1·1	65·8	69·8	17610
310	37×3·27	22·9	25·9	51·8	53·8	3·0	59·8	63·8	55×1·1	68·2	72·2	18750

Insulation { 1·5 mm. of Paper on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 167.—CONSTRUCTIONAL DATA FOR TWO-CORE, PAPER AND JUTE INSULATED, LEAD-CASED AND ARMOURED CABLE FOR 1000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Dia. over Conductor, mm.	Dia. over Paper, mm.	Dia. over laid up cores, mm.	Dia. over Jute, mm.	Lead case		Dia. over Jute serving, mm.	Dimensions of Steel Tapes, mm.	Dia. over Steel Tapes, mm.	Dia. over Jute serving, mm.	Weight of Cable, kilog. per km.
						thickness mm.	Dia. over lead mm.					
10	7×1·35	4·1	8·1	16·2	18·2	1·8	21·8	25·8	25×0·9	29·4	33·4	3240
16	7×1·71	5·1	9·1	18·2	20·2	1·9	24·0	28·0	33×0·9	31·6	35·6	3760
25	7×2·13	6·4	10·4	20·8	22·8	2·05	26·9	30·9	33×0·9	34·5	38·5	4500
35	19×1·53	7·7	11·7	23·4	25·4	2·1	29·6	33·6	33×0·9	37·2	41·2	5180
50	19×1·83	9·2	13·2	26·4	28·4	2·25	32·9	36·9	43×1·0	40·9	44·9	6330
70	19×2·17	10·9	14·9	29·8	31·8	2·35	36·5	40·5	43×1·0	44·5	48·5	7860
95	19×2·53	12·7	16·7	33·4	35·4	2·5	40·4	44·4	43×1·0	48·4	52·4	8810
120	19×2·83	14·2	18·2	36·4	38·4	2·55	43·5	47·5	55×1·1	51·5	55·5	10130
150	19×3·17	15·9	19·9	39·8	41·8	2·7	47·2	51·2	55×1·1	55·6	59·6	11640
185	19×3·52	17·6	21·6	43·2	45·2	2·8	50·8	54·8	55×1·1	59·2	63·2	13200
210	19×3·75	18·8	22·8	45·6	47·6	2·9	53·4	57·4	55×1·1	61·8	65·8	14380
240	19×4·01	20·1	24·1	48·2	50·2	3·0	56·2	60·2	55×1·1	64·6	68·6	15730
280	37×3·1	21·7	25·7	51·4	53·4	3·0	59·4	63·4	55×1·1	67·8	71·8	17210
310	37×3·27	22·9	26·9	53·8	55·8	3·0	61·8	65·8	55×1·1	70·2	74·2	18480

Insulation { 2·0 mm. of Paper on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 168.—CONSTRUCTIONAL DATA FOR TWO-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 2000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam. over Conductor, mm.	Diam. over Paper, mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case		Dia. over Jute Serving, mm.	Dimensions of Steel Tapes, mm.	Diam. over Steel Tapes, mm.	Dia. over Jute Serving, mm.	Weight of Cable, kilog. per km.
						Thickness, mm.	Dia. over Lead, mm.					
10	7×1·35	4·1	8·6	17·2	19·2	1·85	22·9	26·9	25×0·9	30·5	34·5	3440
16	7×1·71	5·1	9·6	19·2	21·2	1·95	25·1	29·1	33×0·9	32·7	36·7	3990
25	7×2·13	6·4	10·9	21·8	23·8	2·05	27·9	31·9	33×0·9	35·5	39·5	4700
35	19×1·53	7·7	12·2	24·4	26·4	2·15	30·7	34·7	33×0·9	38·3	42·3	5420
50	19×1·83	9·2	13·7	27·4	29·4	2·25	33·9	37·9	43×1·0	41·9	45·9	6520
70	19×2·17	10·9	15·4	30·8	32·8	2·4	37·6	41·6	43×1·0	45·6	49·6	7740
95	19×2·53	12·7	17·2	34·4	36·4	2·5	41·4	45·4	43×1·0	49·4	53·4	9050
120	19×2·83	14·2	18·7	37·4	39·4	2·6	44·6	48·6	55×1·1	53·0	57·0	10450
150	19×3·17	15·9	20·4	40·8	42·8	2·75	48·3	52·3	55×1·1	56·7	60·7	11980
185	19×3·52	17·6	22·1	44·2	46·2	2·85	51·9	55·9	55×1·1	60·3	64·3	13570
210	19×3·75	18·8	23·3	46·6	48·6	2·95	54·5	58·5	55×1·1	62·9	66·9	14760
240	19×4·01	20·1	24·6	49·2	51·2	3·0	57·2	61·2	55×1·1	65·6	69·6	16010
280	37×3·1	21·7	26·2	52·4	54·4	3·0	60·4	64·4	55×1·1	68·8	72·8	17500
310	37×3·27	22·9	27·4	54·8	56·8	3·0	62·8	66·8	55×1·1	71·2	75·2	18620

Insulation: {2·25 mm. of Paper on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 169.—CONSTRUCTIONAL DATA FOR TWO-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 3000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam. over Conductor, mm.	Diam. over Paper, mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case		Dia. over Jute Serving, mm.	Dimensions of Steel Tapes, mm.	Diam. over Steel Tapes, mm.	Dia. over Jute Serving, mm.	Weight of Cable, kilog. per km.
						Thickness, mm.	Dia. over Lead, mm.					
10	7×1·35	4·1	9·1	18·2	20·2	1·9	24·0	28·0	33×0·9	31·6	35·6	..
16	7×1·71	5·1	10·1	20·2	22·2	2·0	26·2	30·2	33×0·9	33·8	37·8	..
25	7×2·13	6·4	11·4	22·8	24·8	2·1	29·0	33·0	33×0·9	36·6	40·6	..
35	19×1·53	7·7	12·7	25·4	27·4	2·2	31·8	35·8	33×0·9	39·4	43·4	..
50	19×1·83	9·2	14·2	28·4	30·4	2·3	35·0	39·0	43×1·0	43·0	47·0	..
70	19×2·17	10·9	15·9	31·8	33·8	2·4	38·6	42·6	43×1·0	46·6	50·6	..
95	19×2·53	12·7	17·7	35·4	37·4	2·55	42·5	46·5	43×1·0	50·5	54·5	..
120	19×2·83	14·2	19·2	38·4	40·4	2·65	45·7	49·7	55×1·1	54·1	58·1	..
150	19×3·17	15·9	20·9	41·8	43·8	2·75	49·3	53·3	55×1·1	57·7	61·7	..
185	19×3·52	17·6	22·6	45·2	47·2	2·9	53·0	57·0	55×1·1	61·4	65·4	..
210	19×3·75	18·8	23·8	47·6	49·6	3·0	55·6	59·6	55×1·1	64·0	68·0	..
240	19×4·01	20·1	25·1	50·2	52·2	3·0	58·2	62·2	55×1·1	66·6	70·6	..
280	37×3·1	21·7	26·7	53·4	55·4	3·0	61·4	65·4	55×1·1	69·8	73·8	..
310	37×3·27	22·9	27·9	55·8	57·8	3·0	63·8	67·8	55×1·1	72·2	76·2	..

Insulation: {2·5 mm. of Paper on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 170.—CONSTRUCTIONAL DATA FOR THREE-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 600 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam. over Conductor, mm.	Diam. over Paper, mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case: Thickness, mm.	Lead Case: Dia. over Lead, mm.	Dia. over Jute Serving, mm.	Dimensions of Steel Tape, mm.	Diam. over Steel Tape, mm.	Dia. over Jute Serving, mm.	Weight, of Cable, kilog. per km.
10	7×1·35	4·1	7·1	15·3	16·8	1·7	20·2	24·2	25×0·9	27·8	31·8	3020
16	7×1·71	5·1	8·1	17·4	18·9	1·85	22·6	26·6	25×0·9	30·2	34·2	3650
25	7×2·13	6·4	9·4	20·2	21·7	2·0	25·7	29·7	33×0·9	33·3	37·3	4480
35	19×1·53	7·7	10·7	23·0	24·5	2·1	28·7	32·7	33×0·9	36·3	40·3	5320
50	19×1·83	9·2	12·2	26·3	27·8	2·2	32·2	36·2	43×1·0	40·2	44·2	6548
70	19×2·17	10·9	13·9	30·0	31·5	2·35	36·7	40·7	43×1·0	44·7	48·7	7940
95	19×2·53	12·7	15·7	34·0	35·5	2·5	40·5	44·5	43×1·0	48·5	52·5	9600
120	19×2·83	14·2	17·2	37·1	38·6	2·6	43·8	47·8	55×1·1	52·2	56·2	11200
150	19×3·17	15·9	18·9	40·7	42·2	2·7	47·6	51·6	55×1·1	56·0	60·0	12900
185	19×3·52	17·6	20·6	44·4	45·9	2·85	51·6	55·6	55×1·1	60·0	64·0	14920
210	19×3·75	18·8	21·8	47·0	48·5	2·95	54·4	58·4	55×1·1	62·8	66·8	16350
240	19×4·01	20·1	23·1	49·7	51·2	3·0	57·2	61·2	55×1·1	65·6	69·6	17860
280	37×3·1	21·7	24·7	53·2	54·7	3·0	60·7	64·7	55×1·1	69·1	73·1	19590
310	37×3·27	22·9	25·9	55·8	57·3	3·0	63·3	67·3	55×1·1	71·7	75·7	21080

Insulation: {1·5 mm. of Paper on each core.
0·75 mm. of Jute over laid up cores.

TABLE No. 171.—CONSTRUCTIONAL DATA FOR THREE-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 1000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam. over Conductor mm.	Diam. over Paper, mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case: Thickness, mm.	Lead Case: Dia. over Lead, mm.	Dia. over Jute Serving, mm.	Dimensions of Steel Tape, mm.	Diam. over Steel Tape, mm.	Dia. over Jute Serving, mm.	Weight, of Cable, kilog. per km.
10	7×1·35	4·1	8·1	17·5	19·5	1·85	23·2	27·2	33×0·9	30·8	34·8	3640
16	7×1·71	5·1	9·1	19·6	21·6	2·0	25·6	29·6	33×0·9	33·2	37·2	4280
25	7×2·13	6·4	10·4	22·4	24·4	2·1	28·6	32·6	33×0·9	36·2	40·2	5110
35	19×1·53	7·7	11·7	25·2	27·2	2·2	31·6	35·6	33×0·9	39·2	43·2	5970
50	19×1·83	9·2	13·2	28·4	30·4	2·3	35·0	39·0	43×1·0	43·0	47·0	7260
70	19×2·17	10·9	14·9	32·1	34·1	2·45	39·0	43·0	43×1·0	47·0	51·5	8710
95	19×2·53	12·7	16·7	36·0	38·0	2·55	43·1	47·1	55×1·1	51·0	55·0	10470
120	19×2·83	14·2	18·2	39·2	41·2	2·7	46·6	50·6	55×1·1	55·5	59·0	12060
150	19×3·17	15·9	19·9	42·9	44·9	2·8	50·5	54·5	55×1·1	58·9	62·9	13840
185	19×3·52	17·6	21·6	46·5	48·5	2·95	54·4	58·4	55×1·1	62·8	66·8	15870
210	19×3·75	18·8	22·8	49·1	51·1	3·0	57·1	61·1	55×1·1	65·5	69·5	17240
240	19×4·01	20·1	24·1	51·9	53·9	3·0	59·9	63·9	55×1·1	68·3	72·3	18680
280	37×3·1	21·7	25·7	55·4	57·4	3·0	63·4	67·4	55×1·1	71·8	75·8	20540
310	37×3·27	22·9	26·9	58·0	60·0	3·0	66·0	70·0	55×1·1	74·4	78·4	21920

Insulation: {2·0 mm. of Paper on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 172.—CONSTRUCTIONAL DATA FOR THREE-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 2000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam over Conductor, mm.	Diam. over Paper. mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case Thickness, mm.	Lead Case Dia. over Lead, mm.	Dia. over Jute Serving, mm.	Dimensions of Steel Tape, mm.	Diam. over Steel Tape, mm.	Dia. over Jute Serving, mm.	Weight, of Cable, kilog. per km.
10	7×1·35	4·1	8·6	18·4	20·4	1·9	24·2	28·2	33×0·9	31·8	35·8	3850
16	7×1·71	5·1	9·6	20·7	22·7	2·05	26·8	30·8	33×0·9	34·4	38·4	4550
25	7×2·13	6·4	10·9	23·5	25·5	2·1	29·7	33·7	33×0·9	37·3	41·3	5330
35	19×1·53	7·7	12·2	26·3	28·3	2·2	32·7	36·7	43×1·0	40·7	44·7	6230
50	19×1·83	9·2	13·7	29·4	31·4	2·35	36·1	40·1	43×1·0	44·1	48·1	7560
70	19×2·17	10·9	15·4	33·1	35·3	2·45	40·0	44·0	43×1·0	48·0	52·0	8960
95	19×2·53	12·7	17·2	37·0	39·0	2·6	44·2	48·2	55×1·1	52·6	56·6	10820
120	19×2·83	14·2	18·7	40·3	42·3	2·7	47·7	51·7	55×1·1	56·1	60·1	12360
150	19×3·17	15·9	20·4	43·8	45·8	2·85	51·5	55·5	55×1·1	59·9	63·9	14230
185	19×3·52	17·6	22·1	47·5	49·5	2·95	55·4	59·4	55×1·1	63·8	67·8	16190
210	19×3·75	18·8	23·3	50·1	52·1	3·0	58·1	62·1	55×1·1	66·5	70·5	17560
240	19×4·01	20·1	24·6	52·9	54·9	3·0	60·9	64·9	55×1·1	69·3	73·3	19000
280	37×3·1	21·7	26·2	56·5	58·5	3·0	64·5	68·5	55×1·1	72·9	76·9	20880
310	37×3·27	22·9	27·4	59·0	61·0	3·0	67·0	71·0	55×1·1	75·4	79·4	22250

Insulation: {2·25 mm. of Paper on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 173.—CONSTRUCTIONAL DATA FOR THREE-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 3000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam. over Conductor, mm.	Diam. over Paper, mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case Thickness, mm.	Lead Case Dia over Lead, mm.	Dia. over Jute Serving, mm.	Dimensions of Steel Tape, mm.	Diam. over Steel Tape, mm.	Dia. over Jute Serving, mm.	Weight of Cable, kilog. per km.
10	7×1·35	4·1	9·1	19·5	21·5	1·95	25·4	29·4	33×0·9	33·0	37·0	4100
16	7×1·71	5·1	10·1	21·8	23·8	2·05	27·9	31·9	33×0·9	35·5	39·5	4760
25	7×2·13	6·4	11·4	24·6	26·6	2·15	30·9	34·9	33×0·9	38·5	42·5	5610
35	19×1·53	7·7	12·7	27·3	29·3	2·25	33·8	37·8	43×1·0	41·8	45·8	6650
50	19×1·83	9·2	14·2	30·5	32·5	2·35	37·2	41·2	43×1·0	45·2	49·2	7760
70	19×2·17	10·9	15·9	34·3	36·3	2·5	41·3	45·3	43×1·0	49·3	53·3	9560
95	19×2·53	12·7	17·7	38·0	40·0	2·65	45·3	49·3	55×1·1	53·7	57·7	11180
120	19×2·83	14·2	19·2	41·4	43·4	2·75	48·9	52·9	55×1·1	57·3	61·3	12760
150	19×3·17	15·9	20·9	44·9	46·9	2·85	52·6	56·6	55×1·1	61·0	65·0	14540
185	19×3·52	17·6	22·6	48·7	50·7	3·0	56·7	60·7	55×1·1	65·1	69·1	16650
210	19×3·75	18·8	23·8	51·2	53·2	3·0	59·2	63·2	55×1·1	67·6	71·6	17900
240	19×4·01	20·1	25·1	54·0	56·0	3·0	62·0	66·0	55×1·1	70·4	74·4	19240
280	37×3·1	21·7	26·7	57·5	59·5	3·0	65·5	69·5	55×1·1	73·9	77·9	21210
310	37×3·27	22·9	27·9	60·1	62·1	3·0	68·1	72·1	55×1·1	76·5	80·5	22590

Insulation: {2·5 mm. of Paper on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 174.—CONSTRUCTIONAL DATA FOR THREE-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 6000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam. over Paper, mm.	Dia. over Jute, mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case: Thickness, mm.	Lead Case: Dia. over Lead, mm.	Dia. over Jute Serving, mm.	Dimensions of Steel Tape, mm.	Diam. over Steel Tape, mm.	Dia. over Jute Serving, mm.	Weight, of Cable, kilog. per km.
10	7×1·35	10·1	12·1	26·1	28·1	2·2	32·5	36·5	43×1·0	40·5	44·5	5690
16	7×1·71	11·1	13·1	28·2	30·2	2·3	34·8	38·8	43×1·0	42·8	46·8	6440
25	7×2·13	12·4	14·4	31·0	33·0	2·4	37·8	41·8	43×1·0	45·8	49·8	7330
35	19×1·53	13·7	15·7	33·8	35·8	2·5	40·8	44·8	43×1·0	48·8	52·8	8310
50	19×1·83	15·2	17·2	37·1	39·1	2·6	44·3	48·3	55×1·1	52·7	56·7	9760
70	19×2·17	16·9	18·9	40·7	42·7	2·75	48·2	52·2	55×1·1	56·6	60·6	11370
95	19×2·53	18·7	20·7	41·6	46·6	2·85	52·3	56·3	55×1·1	60·7	64·7	13125
120	19×2·83	20·2	22·2	47·8	49·8	3·0	55·8	59·8	55×1·1	64·2	68·2	14850
150	19×3·17	21·9	23·9	51·5	53·5	3·0	59·5	63·5	55×1·1	67·9	71·9	16550

Insulation: { 3 mm. of Paper plus 1·0 mm. of Jute on each core.
1·0 mm. of Jute over laid up cores.

TABLE No. 175.—CONSTRUCTIONAL DATA FOR THREE-CORE, PAPER AND JUTE INSULATED, LEAD CASED AND ARMOURED CABLE FOR 10,000 VOLTS WORKING PRESSURE.

Area of Conductor, sq. mm.	Conductor Strand, mm.	Diam, over Paper, mm.	Dia. over Jute, mm.	Diam. over Laid up Cores, mm.	Dia. over Jute, mm.	Lead Case: Thickness, mm.	Lead Case: Dia. over Lead, mm.	Dia. over Jute Serving, mm.	Dimensions of Steel Tape, mm.	Diam. over Steel Tape, mm.	Dia. over Jute Serving, mm.	Weight, of Cable, kilog. per km.
10	7×1·35	12·1	16·1	34·7	38·7	2·7	44·1	48·1	55×1·1	52·5	56·5	9120
16	7×1·71	13·1	17·1	36·9	40·9	2·75	46·4	50·4	55×1·1	54·8	58·8	9910
25	7×2·13	14·4	18·4	39·7	43·7	2·8	49·3	53·3	55×1·1	57·7	61·7	10940
35	19×1·53	15·7	19·7	42·5	46·5	2·9	52·3	56·3	55×1·1	60·7	64·7	12120
50	19×1·83	17·2	21·2	45·7	49·7	2·95	55·6	59·6	55×1·1	64·0	68·0	13460
70	19×2·17	18·9	22·9	49·4	53·4	3·0	59·4	63·4	55×1·1	67·8	71·8	15080
95	19×2·53	20·7	24·7	53·2	57·2	3·0	63·2	67·2	55×1·1	71·6	75·6	16750
120	19×2·83	22·2	26·2	56·5	60·5	3·0	66·5	70·5	55×1·1	74·9	78·9	18280
150	19×3·17	23·9	27·9	60·1	64·1	3·0	70·1	74·1	55×1·1	78·5	82·5	20020

Insulation: { 4·0 mm. of Paper plus 2·0 mm. of Jute on each core.
2 0 mm. of Jute over laid up cores.

TABLE No. 176.—CONSTRUCTIONAL DATA FOR IMPREGNATED JUTE CABLE, SINGLE CONDUCTOR FOR 500 VOLTS INSTALLATION WORK. (All dimensions given in mm.)

Cross Section of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Insulating Jute		Lead Sheath		Diam. over Jute Serving	Steel Tape Armour		Diam. over Jute, Serving	Steel Wire Armour			Diam. over Jute Serving	Weight of Cable, kilog. per km.
			Thickness	Diam. over	Thickness	Diam. over		Dimensions	Diam. over		No. of Wires	Diam., Wire	Diam. over		
1	1 × 1·13	1·13	1·1	3·3	1·0	5·3	6·3	..	..	..	16	1·5	9·3	12·3	510
1·5	1 × 1·38	1·4	1·1	3·6	1·0	5·6	6·6	..	..	..	17	1·5	9·6	12·6	540
2·5	1 × 1·79	1·8	1·1	4·0	1·0	6·0	7·0	..	..	..	18	1·5	10·0	13·2	610
4	1 × 2·26	2·3	1·1	4·5	1·1	6·7	7·7	..	..	..	19	1·5	10·7	13·7	670
6	1 × 2·76	2·8	1·1	5·0	1·1	7·2	8·2	..	..	..	16	2·0	12·2	15·4	850
10	1 × 3·57	3·6	1·1	5·8	1·1	8·0	9·0	..	..	..	17	2·0	13·0	16·2	960
16	7 × 1·71	5·1	1·1	7·3	1·1	9·5	10·5	..	..	..	19	2·0	14·5	17·7	1150
25	7 × 2·13	6·4	1·1	8·6	1·1	10·8	11·8	..	..	..	21	2·0	15·8	19·0	1350
35	19 × 1·53	7·65	1·1	9·9	1·2	12·3	13·3	..	..	..	24	2·0	17·3	20·5	1630
50	19 × 1·83	9·15	1·5	12·2	1·2	14·6	15·6	..	..	..	27	2·0	19·6	22·8	2000
70	19 × 2·17	10·85	1·5	13·9	1·3	16·5	20·5	25 × 0·9	24·1	28·1	..	..	..	..	2140
95	19 × 2·53	12·65	1·5	15·7	1·3	18·3	22·3	25 × 0·9	25·9	29·9	..	..	..	..	2970
120	19 × 2·83	14·15	1·5	17·2	1·4	20·0	24·0	25 × 0·9	27·6	31·6	..	..	..	..	3340
150	19 × 3·17	15·85	1·5	18·9	1·5	21·9	25·9	25 × 0·9	29·5	33·5	..	..	..	..	3880
185	19 × 3·52	17·6	1·5	20·6	1·5	23·6	27·6	33 × 0·9	31·2	35·2	..	..	..	..	4400
210	19 × 3·75	18·75	1·5	21·8	1·6	25·0	29·0	33 × 0·9	32·6	36·6	..	..	..	..	4760
240	19 × 4·01	20·05	1·5	23·1	1·6	26·3	30·3	33 × 0·9	33·9	37·9	..	..	..	..	5280
280	37 × 3·1	21·7	1·5	24·7	1·7	28·1	32·1	33 × 0·9	35·7	39·7	..	..	..	..	5840
310	37 × 3·27	22·9	1·5	25·9	1·7	29·3	33·3	33 × 0·9	36·9	40·9	..	..	..	..	6360
355	37 × 3·5	24·5	1·5	27·5	1·8	31·1	35·1	33 × 0·9	38·7	42·7	..	..	..	..	6940
400	37 × 3·71	26·0	2·0	30·0	1·8	33·6	37·6	43 × 1·0	41·6	45·6	..	..	..	..	8040
500	37 × 4·15	29·05	2·0	33·1	1·9	36·9	40·9	43 × 1·0	44·9	48·9	..	..	..	..	9470
625	61 × 3·62	32·6	2·0	36·6	2·1	40·8	44·8	43 × 1·0	48·8	52·8	..	..	..	..	11200
725	61 × 3·9	35·1	2·0	39·1	2·1	43·3	47·3	55 × 1·1	51·3	55·5	..	..	..	..	12600
800	61 × 4·09	36·8	2·0	40·8	2·2	45·2	49·2	55 × 1·1	53·2	57·4	..	..	..	..	13670
1000	91 × 3·74	41·1	2·0	45·1	2·3	49·7	53·7	55 × 1·1	58·1	62·1	..	..	..	..	16440

TABLE No. 177.—CONSTRUCTIONAL DATA FOR IMPREGNATED JUTE CABLES FOR 600 VOLTS WORKING PRESSURE. (Single conductor.) (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Insulating Jute		Lead Sheath		Diam. over Jute Serving	Steel Tape Armour		Diam. over Serving Jute
			Thickness	Diam. over	Thickness	Diam. over		Dimensions of Tape	Diam. over	
10	7 × 1·35	4·05	2·0	8·1	1·5	11·1	15·1	20 × 0·8	18·3	22·0
16	7 × 1·71	5·13	2·0	9·1	1·5	12·1	16·1	20 × 0·8	19·3	23·0
25	7 × 2·13	6·39	2·0	10·4	1·5	13·4	17·4	20 × 0·8	20·6	24·0
35	19 × 1·53	7·65	2·0	11·7	1·55	14·8	18·8	20 × 0·8	22·0	26·0
50	19 × 1·83	9·15	2·0	13·2	1·55	16·3	20·3	25 × 0·9	23·9	28·0
70	19 × 2·17	10·85	2·0	14·9	1·6	18·1	22·1	25 × 0·9	25·7	30·0
95	19 × 2·53	12·65	2·0	16·7	1·7	20·1	24·1	25 × 0·9	27·7	32·0
120	19 × 2·83	14·15	2·0	18·2	1·8	21·8	25·8	25 × 0·9	29·4	33·0
150	19 × 3·17	15·85	2·0	19·9	1·9	23·7	27·7	33 × 0·9	31·3	35·0
185	19 × 3·52	17·60	2·0	21·6	2·0	25·6	29·6	33 × 0·9	33·2	37·0
210	19 × 3·75	18·75	2·0	22·8	2·05	26·9	30·9	33 × 0·9	34·5	39·0
240	19 × 4·01	20·05	2·0	24·1	2·1	28·3	32·3	33 × 0·9	35·9	40·0
280	37 × 3·1	21·70	2·0	25·7	2·15	30·0	34·0	33 × 0·9	37·6	42·0
310	37 × 3·27	22·89	2·0	26·9	2·2	31·3	35·3	33 × 0·9	38·9	43·0
355	37 × 3·5	24·50	2·0	28·5	2·25	33·0	37·0	43 × 1·0	41·0	45·0
400	37 × 3·71	25·97	2·0	30·0	2·3	34·6	38·6	43 × 1·0	42·6	47·0
500	37 × 4·15	29·05	2·0	33·1	2·4	37·9	41·9	43 × 1·0	45·9	50·0
625	61 × 3·62	32·58	2·0	36·6	2·5	41·6	45·6	55 × 1·1	50·0	54·0
725	61 × 3·9	35·1	2·0	39·1	2·6	44·3	48·3	55 × 1·1	52·7	57·0
800	61 × 4·09	36·81	2·0	40·8	2·65	46·1	50·1	55 × 1·1	54·5	59·0
1000	91 × 3·74	41·14	2·0	45·1	2·8	50·7	54·7	55 × 1·1	59·1	63·0

TABLE No. 178.—CONSTRUCTIONAL DATA FOR SINGLE CONDUCTOR, IMPREGNATED JUTE CABLE WITH TEST WIRE FOR 700 VOLTS WORKING PRESSURE. (Dimensions given in mm.)

Sectional Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Insulating Jute		Lead Sheath		Dia. over Jute Serving	Steel Tape Armour		Dia. over Jute Serving	Wght. of Cable, kilog. per km.	Dia. over Jute Serving	Steel Wire or Strip Armour				Dia. over Jute Serving	Wght. of Cable, kilog. per km.
			Thickness	Dia. over	Thickness	Dia. over		Dimensions	Dia. over				No. of Wires	Dimensions	Description of Armour	Dia. over		
10	3×2·06	4·97	2·0	9·0	1·5	12·0	16·0	20×0·5	18·0	22·0	1260	13·0	23	2·0 diam.	round wire	17·0	20·2	1530
16	3×2·6	6·4	2·0	10·4	1·5	13·4	17·4	20×0·5	19·4	23·4	1450	14·4	25	2·0 ,,	,,	18·4	21·6	1750
25	6×2·3	6·9	2·0	10·9	1·5	13·9	17·9	20×0·5	19·9	23·9	1580	14·9	26	2·0 ,,	,,	18·9	22·1	1890
35	6×2·73	8·2	2·0	12·2	1·6	15·4	19·4	20×0·8	22·6	26·6	2130	16·4	28	2·0 ,,	,,	20·4	23·6	2190
50	6×3·26	9·8	2·0	13·8	1·6	17·0	21·0	20×0·8	21·2	28·2	2460	18·0	31	2·0 ,,	,,	22·0	25·2	2530
70	13×2·6	11·5	2·0	15·5	1·7	18·9	22·9	20×0·8	26·1	30·1	2930	19·9	34	2·0 ,,	,,	23·9	27·0	2990
95	18×2·59	12·95	2·0	17·0	1·7	20·4	24·4	20×0·8	27·6	31·6	3350	21·4	36	2·0 ,,	,,	25·4	28·6	3390
120	18×2·91	14·55	2·0	18·6	1·8	22·2	26·2	43×1·0	30·2	34·2	4100	23·2	16	4·9×4·3×1·7	segmental strip	26·6	29·8	3925
150	18×3·26	16·3	2·5	21·3	1·9	25·1	29·1	43×1·0	33·1	37·1	4890	26·1	17	4·9×4·3×1·7	,,	29·5	33·0	4936
185	26×3·0	18·5	2·5	23·5	2·0	27·5	32·5	43×1·0	36·5	40·5	5670	28·5	19	4·9×4·3×1·7	,,	31·9	35·0	5383
210	26×3·21	19·8	2·5	24·8	2·0	28·8	33·8	43×1·0	37·8	41·8	6090	29·8	20	4·9×4·3×1·7	,,	33·2	36·4	5800
240	29×3·25	20·8	2·5	25·8	2·1	30·0	35·0	43×1·0	39·0	43·0	6630	31·0	20	4·9×4·3×1·7	,,	34·4	37·6	6270
280	36×3·15	22·05	2·5	27·1	2·1	31·3	36·3	43×1·0	40·3	44·3	7190	32·3	21	4·9×4·3×1·7	,,	35·7	39·0	6830
310	36×3·31	23·2	2·5	28·2	2·2	32·6	37·6	43×1·0	41·6	45·6	7740	33·6	22	4·9×4·3×1·7	,,	36·4	39·6	7390
355	36×3·55	24·85	2·5	29·9	2·2	34·3	39·3	43×1·0	43·3	47·3	8380	35·3	23	4·9×4·3×1·7	,,	38·1	41·3	8040
400	36×3·76	26·3	3·0	31·3	2·3	35·9	40·9	43×1·0	44·9	48·9	9150	36·9	24	4·9×4·3×1·7	,,	40·3	43·5	8790
500	36×4·21	29·5	3·0	35·5	2·4	40·3	46·3	43×1·0	50·3	51·3	11130	41·3	27	4·9×4·3×1·7	,,	44·7	47·9	10540
625	60×3·65	32·85	3·0	38·9	2·6	44·1	50·1	43×1·0	54·1	58·1	13230	45·1	29	4·9×4·3×1·7	,,	48·5	51·7	12500
725	60×3·92	35·3	3·0	41·3	2·7	46·7	52·7	43×1·0	56·7	60·7	14710	47·7	31	4·9×4·3×1·7	,,	51·1	54·3	13970
800	60×4·12	37·1	3·0	43·1	2·8	48·7	54·7	43×1·0	58·7	62·7	15880	49·7	32	4·9×4·3×1·7	,,	53·1	56·1	15120
1000	90×3·76	41·4	3·0	47·4	3·0	53·4	59·4	43×1·0	63·4	67·4	18840	54·4	35	4·9×4·3×1·7	,,	57·8	61·0	18030

TABLE No. 179.—CONSTRUCTIONAL DATA FOR SINGLE CONDUCTOR, IMPREGNATED JUTE CABLE FOR 1000 VOLTS WORKING PRESSURE. (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Insulating Jute		Lead Sheath		Diam. over Jute Serving	Steel Tape Armour		Diam over Jute Serving
			Thickness	Diam. over	Thickness	Diam. over		Dimensions of Tape	Diam. over	
10	7×1·35	4·05	2·5	9·1	1·5	12·1	16·1	20×0·8	19·3	23·0
16	7×1·71	5·13	2·5	10·1	1·5	13·1	17·1	20×0·8	20·3	24·0
25	7×2·13	6·39	2·5	11·4	1·55	14·5	18·5	20×0·8	21·7	26·0
35	19×1·53	7·65	2·5	12·7	1·55	15·8	19·8	20×0·8	23·0	27·0
50	19×1·83	9·15	2·5	14·2	1·6	17·4	21·4	25×0·9	25·0	29·0
70	19×2·17	10·85	2·5	15·9	1·65	19·2	23·2	25×0·9	26·8	31·0
95	19×2·53	12·65	2·5	17·7	1·75	21·2	25·2	25×0·9	28·8	33·0
120	19×2·83	14·15	2·5	19·2	1·85	22·9	26·9	25×0·9	30·5	35·0
150	19×3·17	15·85	2·5	20·9	1·95	24·8	28·8	33×0·9	32·4	36·0
185	19×3·52	17·60	2·5	22·6	2·05	26·7	30·7	33×0·9	34·3	38·0
210	19×3·75	18·75	2·5	23·8	2·05	27·9	31·9	33×0·9	35·5	40·0
240	19×4·01	20·05	2·5	25·1	2·10	29·3	33·3	33×0·9	36·9	41·0
280	37×3·1	21·70	2·5	26·7	2·15	31·0	35·0	33×0·9	38·6	43·0
310	37×3·27	22·89	2·5	27·9	2·2	32·3	36·3	43×1·0	40·3	44·0
355	37×3·5	24·50	2·5	29·5	2·25	34·0	38·0	43×1·0	42·0	46·0
400	37×3·71	25·97	2·5	31·0	2·3	35·6	39·6	43×1·0	43·6	48·0
500	37×4·15	29·05	2·5	34·1	2·45	39·0	43·0	43×1·0	47·0	51·0
625	61×3·62	32·58	2·5	37·6	2·55	42·7	46·7	55×1·1	51·1	55·0
725	61×3·9	35·10	2·5	40·1	2·65	45·4	49·4	55×1·1	53·8	58·0
800	61×4·09	36·81	2·5	41·8	2·7	47·2	51·2	55×1·1	55·6	60·0
1000	91×3·74	41·14	2·5	46·1	2·85	51·8	55·8	55×1·1	60·2	64·0

TABLE No. 180.—CONSTRUCTIONAL DATA FOR SINGLE CONDUCTOR, IMPREGNATED JUTE CABLE FOR 3000 VOLTS WORKING PRESSURE. (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Insulating Jute		Lead Sheath		Diam. over Jute Serving	Steel Tape Armour		Diam. over Jute Serving
			Thickness	Diam. over	Thickness	Diam. over		Dimensions of Tape	Diam. over	
10	7×1·35	4·05	3·0	10·1	1·5	13·1	17·1	20×0·8	20·3	24·0
16	7×1·71	5·13	3·0	11·1	1·5	14·1	18·1	20×0·8	21·3	25·0
25	7×2·13	6·39	3·0	12·4	1·55	15·5	19·5	20×0·8	22·7	27·0
35	19×1·53	7·65	3·0	13·7	1·6	16·9	20·9	25×0·9	24·5	29·0
50	19×1·83	9·15	3·0	15·2	1·6	18·4	22·4	25×0·9	26·0	30·0
70	19×2·17	10·85	3·0	16·9	1·7	20·3	24·3	25×0·9	27·9	32·0
95	19×2·53	12·65	3·0	18·7	1·8	22·3	26·3	25×0·9	29·9	34·0
120	19×2·83	14·15	3·0	20·2	1·9	24·0	28·0	33×0·9	31·6	36·0
150	19×3·17	15·85	3·0	21·9	2·0	25·9	29·9	33×0·9	33·5	38·0
185	19×3·52	17·6	3·0	23·6	2·05	27·7	31·7	33×0·9	35·3	39·0
210	19×3·75	18·75	3·0	24·8	2·1	29·0	33·0	33×0·9	36·6	41·0
240	19×4·01	20·05	3·0	26·1	2·15	30·4	34·4	33×0·9	38·0	42·0
280	37×3·1	21·7	3·0	27·7	2·2	32·1	36·1	43×1·0	40·1	44·0
310	37×3·27	22·89	3·0	28·9	2·25	33·4	37·4	43×1·0	41·4	45·0
355	37×3·5	24·5	3·0	30·5	2·3	35·1	39·1	43×1·0	43·1	47·0
400	37×3·71	25·97	3·0	32·0	2·35	36·7	40·7	43×1·0	44·7	49·0
500	37×4·15	29·05	3·0	35·1	2·45	40·0	44·0	43×1·0	48·0	52·0
625	61×3·62	32·58	3·0	38·6	2·6	43·8	47·8	55×1·1	52·2	56·0
725	61×3·9	35·1	3·0	41·1	2·7	46·5	50·5	55×1·1	54·9	59·0
800	61×4·09	36·81	3·0	42·8	2·75	48·3	52·3	55×1·1	56·7	61·0
1000	91×3·74	41·14	3·0	47·1	2·9	52·9	56·9	55×1·1	61·3	65·0

TABLE No. 181.—CONSTRUCTIONAL DATA OF TWO-CORE IMPREGNATED JUTE CABLE. (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Diam. over Jute	Diam. over laid up Cores	Diam. over Jute	Lead Sheath		Diam. over Jute Serving	Dimensions of Steel Tape	Diam. over Steel Tape	Diam. over Jute Serving	Weight of Cable, kilog. per km.	Working Pressure and Thickness of Dielectric
						Thickness	Diam. over Lead						
10	7 × 1·35	4·05	8·1	16·2	18·2	1·8	21·8	25·8	25 × 0·9	29·8	33·8	3330	1000 volts working pressure: 2·0 mm. Jute on each core; 1·0 mm. Jute over laid up cores.
16	7 × 1·71	5·13	9·1	18·2	20·2	1·9	24·0	28·0	33 × 0·9	32·0	36·0	3910	
25	7 × 2·13	6·4	10·4	20·8	22·8	2·05	26·9	30·9	33 × 0·9	34·9	38·9	4620	
35	19 × 1·53	7·65	11·7	23·4	25·4	2·1	29·6	33·6	33 × 0·9	37·6	41·6	5290	
50	19 × 1·83	9·15	13·2	26·4	28·4	2·2	32·8	36·8	43 × 1·0	40·8	44·8	6520	
70	19 × 2·17	10·85	14·9	29·8	31·8	2·35	36·5	40·5	43 × 1·0	44·5	48·5	7690	
95	19 × 2·53	12·65	16·7	33·4	35·4	2·5	40·4	44·4	43 × 1·0	48·4	52·4	9010	
120	19 × 2·83	14·2	18·2	36·4	38·4	2·6	43·6	47·6	55 × 1·1	52·0	56·0	10400	
150	19 × 3·17	15·85	19·9	39·8	41·8	2·7	47·2	51·2	55 × 1·1	55·6	59·6	11840	
10	7 × 1·35	4·05	10·1	20·2	22·2	2·0	26·2	30·2	33 × 0·9	34·2	38·2	4200	2000 volts working pressure: 3·0 mm. Jute on each core; 1·0 mm. Jute over laid up cores.
16	7 × 1·71	5·13	11·1	22·2	24·2	2·1	28·4	32·4	33 × 0·9	36·4	40·4	4780	
25	7 × 2·13	6·4	12·4	24·8	26·8	2·2	31·2	35·2	33 × 0·9	39·2	43·2	5570	
35	19 × 1·53	7·65	13·7	27·4	29·4	2·25	33·9	37·9	43 × 1·0	41·9	45·9	6450	
50	19 × 1·83	9·15	15·2	30·4	32·4	2·35	37·1	41·1	43 × 1·0	45·1	49·1	7450	
70	19 × 2·17	10·85	16·9	33·8	35·8	2·5	40·8	44·8	43 × 1·0	48·8	52·8	8730	
95	19 × 2·53	12·65	18·7	37·4	39·4	2·6	44·6	48·6	55 × 1·1	53·0	57·0	10290	
120	19 × 2·83	14·2	20·2	40·4	42·4	2·7	47·8	51·8	55 × 1·1	56·2	60·2	11570	
150	19 × 3·17	15·85	21·9	43·8	45·8	2·8	51·4	55·4	55 × 1·1	59·8	63·8	12860	
10	7 × 1·35	4·05	12·1	24·2	26·2	2·15	30·5	34·5	33 × 0·9	38·5	42·5	5160	3000 volts working pressure: 4·0 mm. Jute on each core; 1·0 mm. Jute over laid up cores.
16	7 × 1·71	5·13	13·1	26·2	28·2	2·25	32·7	36·7	43 × 1·0	40·7	44·7	6070	
25	7 × 2·13	6·4	14·4	28·8	30·8	2·3	35·4	39·4	43 × 1·0	43·4	47·4	6700	
35	19 × 1·53	7·65	15·7	31·4	33·4	2·4	38·2	42·2	43 × 1·0	46·2	50·2	7560	
50	19 × 1·83	9·15	17·2	34·4	36·4	2·5	41·4	45·4	43 × 1·0	49·4	53·4	8590	
70	19 × 2·17	10·85	18·9	37·8	39·8	2·6	45·0	49·0	55 × 1·1	53·4	57·4	10030	
95	19 × 2·53	12·65	20·7	41·4	43·4	2·75	48·9	52·9	55 × 1·1	57·3	61·3	11540	
120	19 × 2·83	14·2	22·2	44·4	46·4	2·85	52·1	56·1	55 × 1·1	60·5	64·5	12910	
150	19 × 3·17	15·85	23·9	47·8	49·8	3·0	55·8	59·8	55 × 1·1	64·2	68·2	14540	

Table No. 182.—Constructional Data for Three-Core Impregnated Jute Cable for 600 Volts Working Pressure. (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Insulating Jute		Dia. over laid up Cores	Insulating Jute		Lead Sheath		Dia. over Jute Serving	Steel Tape Armour		Dia. over Jute Serving
			Thickness	Dia. over Jute		Thickness	Dia. over Jute	Thickness	Dia. over Lead		Dimensions of Tape	Dia. over Tape	
10	7×1·35	4·05	3·0	7·0	15·1	1·5	16·6	1·7	20·0	24·0	25×0·9	27·6	32·0
16	7×1·71	5·13	3·0	8·1	17·4	1·5	18·9	1·85	22·6	26·6	25×0·9	30·2	34·0
25	7×2·13	6·39	3·0	9·4	20·2	1·5	21·7	2·0	25·7	29·7	33×0·9	33·3	37·0
35	19×1·53	7·65	3·0	10·7	23·0	1·5	24·5	2·1	28·7	32·7	33×0·9	36·3	40·0
50	19×1·83	9·15	3·0	12·2	26·3	1·5	27·8	2·2	32·2	36·2	43×1·0	40·2	44·0
70	19×2·17	10·85	3·0	13·9	30·0	1·5	31·5	2·35	36·2	40·2	43×1·0	44·2	48·0
95	19×2·53	12·65	3·0	15·7	34·0	1·5	35·5	2·5	40·5	44·5	43×1·0	48·5	53·0
120	19×2·83	14·15	3·0	17·2	37·1	1·5	38·6	2·6	43·8	47·8	55×1·1	52·2	56·0
150	19×3·17	15·85	3·0	18·9	40·7	1·5	42·2	2·7	47·6	51·6	55×1·1	56·0	60·0
185	19×3·52	17·60	3·0	20·6	44·4	1·5	45·9	2·85	51·6	55·6	55×1·1	60·0	64·0
210	19×3·75	18·75	3·0	21·8	47·0	1·5	48·5	2·95	54·4	58·4	55×1·1	62·8	67·0
240	19×4·01	20·05	3·0	23·1	49·7	1·5	51·2	3·0	57·2	61·2	55×1·1	65·6	70·0
280	37×3·1	21·7	3·0	24·7	53·2	1·5	54·7	3·0	60·7	64·7	55×1·1	69·1	73·0
310	37×3·27	22·9	3·0	25·9	55·8	1·5	57·3	3·0	63·3	67·3	55×1·1	71·7	76·0

TABLE NO. 183.—CONSTRUCTIONAL DATA FOR THREE-CORE IMPREGNATED JUTE CABLE. (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Diam. over Jute	Diam. over laid up Cores	Diam. over Jute	Lead Sheath		Diam. over Jute Serving	Dimensions of Steel Tape	Diam. over Steel Tape	Diam. over Jute Serving	Weight of Cable, kilog. per km.	Working Pressure and Thickness of Dielectric
						Thickness	Dia. over Lead						
10	7 × 1·35	4·05	8·1	17·5	19·5	1·85	23·2	27·2	33 × 0·9	30·8	34·8	3620	1000 volts Working Pressure: 2·0 mm. of Jute on each core. 1·0 mm. of Jute over laid up cores.
16	7 × 1·71	5·13	9·1	19·6	21·6	2·0	25·6	29·6	33 × 0·9	33·2	37·2	4260	
25	7 × 2·13	6·40	10·4	22·4	24·4	2·1	28·6	32·6	33 × 0·9	36·2	40·2	5100	
35	19 × 1·53	7·65	11·7	25·2	27·2	2·2	31·6	35·6	33 × 0·9	39·2	43·2	5940	
50	19 × 1·83	9·15	13·2	28·4	30·4	2·3	35·0	39·0	43 × 1·0	43·0	47·0	7220	
70	19 × 2·17	10·85	14·9	32·1	34·1	2·45	39·0	43·0	43 × 1·0	47·0	51·0	8660	
95	19 × 2·53	12·65	16·7	36·0	38·0	2·55	43·1	47·1	55 × 1·1	51·5	55·5	10410	
120	19 × 2·83	14·2	18·2	39·2	41·2	2·7	46·6	50·6	55 × 1·1	55·0	59·0	12000	
150	19 × 3·17	15·85	19·9	42·9	44·9	2·8	50·5	54·5	55 × 1·1	58·9	62·9	13770	
185	19 × 3·52	17·6	21·6	46·5	48·5	2·95	54·4	58·4	55 × 1·1	62·8	66·8	15800	
210	19 × 3·75	18·75	22·8	49·1	51·1	3·0	57·1	61·1	55 × 1·1	65·5	69·5	17160	
240	19 × 4·01	20·05	24·1	51·9	53·9	3·0	59·9	63·9	55 × 1·1	68·3	72·3	18590	
280	37 × 3·1	21·7	25·7	55·4	57·4	3·0	63·4	67·4	55 × 1·1	71·8	75·8	20440	
310	37 × 3·27	22·9	26·9	58·0	60·0	3·0	66·0	70·0	55 × 1·1	74·4	78·4	21820	
10	7 × 1·35	4·05	10·5	21·7	23·7	2·05	27·8	31·8	33 × 0·9	35·4	39·4	4570	2000 volts Working Pressure: 3·0 mm. of Jute on each core. 1·0 mm. of Jute over laid up cores.
16	7 × 1·71	5·13	11·13	24·0	26·0	2·15	30·3	34·3	33 × 0·9	37·9	41·9	5250	
25	7 × 2·13	6·40	12·4	26·7	28·7	2·25	33·2	37·2	43 × 1·0	41·2	45·2	6270	
35	19 × 1·53	7·65	13·65	29·4	31·4	2·35	36·1	40·1	43 × 1·0	44·1	48·1	7200	
50	19 × 1·83	9·15	15·15	32·6	34·6	2·45	39·5	43·5	43 × 1·0	47·5	51·5	8390	
70	19 × 2·17	10·85	16·85	36·3	38·3	2·55	43·4	47·4	55 × 1·1	51·8	55·8	9980	
95	19 × 2·53	12·65	18·65	40·2	42·2	2·7	47·6	51·6	55 × 1·1	56·0	60·0	11760	
120	19 × 2·83	14·2	20·2	43·5	45·5	2·8	51·1	55·1	55 × 1·1	59·5	63·5	13360	
150	19 × 3·17	15·85	21·85	47·1	49·1	2·95	55·0	59·0	55 × 1·1	63·4	67·4	15280	
185	19 × 3·52	17·6	23·6	50·9	52·9	3·0	58·9	62·9	55 × 1·1	67·3	71·3	17210	
210	19 × 3·75	18·75	24·75	53·3	55·3	3·0	61·3	65·3	55 × 1·1	69·7	73·7	18450	
240	19 × 4·01	20·05	26·05	56·1	58·1	3·0	64·1	68·1	55 × 1·1	72·6	76·6	19910	
280	37 × 3·1	21·7	27·7	59·7	61·7	3·0	67·7	71·7	55 × 1·1	76·1	80·1	21790	
310	37 × 3·27	22·9	28·9	62·3	64·3	3·0	70·3	74·3	55 × 1·1	78·7	82·7	23190	

TABLE No. 183.—CONSTRUCTIONAL DATA FOR THREE-CORE IMPREGNATED JUTE CABLE.—*continued.*
(Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor Strand	Diam. over Conductor	Diam. over Jute	Diam. over laid up Cores	Diam. over Jute	Lead Sheath Thickness	Lead Sheath Diam. over Lead	Diam. over Jute Serving	Dimensions of Steel Tape	Diam. over Steel Tape	Diam. over Jute Serving	Weight of Cable, kilog. per km.	Working Pressure and Thickness of Dielectric
10	7 × 1·35	4·05	12·05	26·0	28·0	2·2	32·4	36·4	43 × 1·0	40·4	44·4	5810	3000 volts Working Pressure: 4·0 mm. of Jute on each core. 1·0 mm. of Jute over laid up cores.
16	7 × 1·71	5·13	13·1	28·2	30·2	2·3	34·8	38·8	43 × 1·0	42·8	46·8	6520	
25	7 × 2·13	6·40	14·4	31·0	33·0	2·4	37·8	41·8	43 × 1·0	45·8	49·8	7460	
35	19 × 1·53	7·65	15·65	33·7	35·7	2·5	40·7	41·7	43 × 1·0	48·7	52·7	8430	
50	19 × 1·83	9·15	17·15	37·0	39·0	2·6	44·2	48·2	55 × 1·1	52·6	56·6	9830	
70	19 × 2·17	10·85	18·85	40·6	42·6	2·75	48·1	52·1	55 × 1·1	56·5	60·5	11420	
95	19 × 2·53	12·65	20·65	44·5	46·5	2·85	52·2	56·2	55 × 1·1	60·6	64·6	13150	
120	19 × 2·83	14·2	22·2	47·8	49·8	3·0	55·8	59·8	55 × 1·1	61·2	68·2	14900	
150	19 × 3·17	15·85	23·85	51·4	53·4	3·0	59·4	63·4	55 × 1·1	67·8	71·8	16540	
185	19 × 3·52	17·6	25·6	55·2	57·2	3·0	63·2	67·2	55 × 1·1	71·6	75·6	18350	
210	19 × 3·75	18·75	26·75	57·7	59·7	3·0	65·7	69·7	55 × 1·1	74·1	78·1	19610	
240	19 × 4·01	20·05	28·1	60·6	62·6	3·0	68·6	72·6	55 × 1·1	77·0	81·0	21070	
280	37 × 3·1	21·7	29·7	64·0	66·0	3·0	72·0	76·0	55 × 1·1	80·4	81·4	23080	
310	37 × 3·27	22·9	30·9	66·6	68·6	3·0	74·6	78·6	55 × 1·1	83·0	87·0	24520	

TABLE No. 184.—CONSTRUCTIONAL DATA FOR CONCENTRIC CONDUCTOR, IMPREGNATED JUTE CABLE FOR 700 VOLTS WORKING PRESSURE. (Dimensions given in mm.)

Area of each Conductor, sq. mm.	Inner Conductor		Insulating Jute		Outer Conductor		Insulating Jute		Lead Sheath		Diam. over Jute Serving	Steel Tape Armour		Diam. over Jute Serving	Weight of Cable, kilog. per km.
	No. and Diam.	Diam. over	Thickness	Diam. over	No. and Diam.	Diam. over	Thickness	Diam. over	Thickness	Diam. over		Dimensions of Tape	Diam. over		
10	7×1·35	4·1	2·5	9·1	10×1·13	11·4	2·0	15·4	1·65	18·7	22·7	25×0·9	26·3	30·3	2570
16	7×1·71	5·1	2·5	10·1	16×1·13	12·4	2·0	16·4	1·7	19·8	23·8	25×0·9	27·4	31·4	2870
25	7×2·13	6·4	2·5	11·4	25×1·13	13·7	2·0	17·7	1·75	21·2	25·2	25×0·9	28·8	32·8	3260
35	19×1·53	7·7	2·5	12·7	32×1·18	15·1	2·0	19·1	1·85	22·8	26·8	25×0·9	30·4	34·4	3640
50	19×1·83	9·2	2·5	14·2	33×1·4	17·0	2·0	21·0	1·95	24·9	28·9	33×0·9	32·5	36·5	4390
70	19×2·17	10·9	2·5	15·9	31×1·7	19·3	2·0	23·3	2·05	27·4	31·4	33×0·9	35·0	39·0	5210
95	19×2·53	12·7	2·5	17·7	29×2·05	21·8	2·0	25·8	2·15	30·1	34·1	33×0·9	37·7	41·7	6160
120	19×2·83	14·2	2·5	19·2	27×2·4	24·0	2·0	28·0	2·2	32·4	36·4	43×1·0	40·4	44·4	7170
150	19×3·17	15·9	2·5	20·9	27×2·66	26·2	2·0	30·2	2·3	34·8	38·8	43×1·0	42·8	46·8	8220
185	19×3·52	17·6	2·5	22·6	25×3·07	28·7	2·0	32·7	2·4	37·5	41·5	43×1·0	45·5	49·5	9410
210	19×3·75	18·8	2·5	23·8	26×3·2	30·2	2·0	34·2	2·45	39·1	43·1	43×1·0	47·1	51·1	10190
240	19×4·01	20·1	2·5	25·1	23×3·65	32·4	2·0	36·4	2·5	41·4	45·4	43×1·0	49·4	53·4	11180
310	37×3·27	22·9	2·5	27·9	24×4·05	36·0	2·0	40·0	2·65	45·3	49·3	55×1·1	53·7	57·7	13490
355	37×3·5	24·5	2·5	29·5	24×4·34	38·2	2·0	42·2	2·7	47·6	51·6	55×1·1	56·0	60·0	14790
400	37×3·71	26·0	2·5	31·0	23×4·71	40·4	2·0	44·4	2·8	50·0	54·0	55×1·1	58·4	62·4	16190
500	37×4·15	29·1	2·5	34·1	22×5·38	44·9	2·0	48·9	2·95	54·8	58·8	55×1·1	63·2	67·2	19140

TABLE NO. 185.—CONSTRUCTIONAL DATA FOR CONCENTRIC CONDUCTOR, IMPREGNATED JUTE CABLE, FOR 1000 VOLTS WORKING PRESSURE.

(Dimensions given in mm.)

Area of each Conductor, sq.mm.	Inner Conductor		Insulating Jute		Outer Conductor		Insulating Jute		Lead Sheath		Diam. over Jute Serving	Steel Tape Armour		Diam. over Jute Serving	Weight of Cable, kilog. per km.
	No. and Diam.	Diam. over	Thickness	Diam. over	No. and Diam.	Diam. over	Thickness	Diam. over	Thickness	Diam. over		Dimensions of Tape	Diam. over		
10	7×1·35	4·05	3·0	10·1	10×1·13	12·4	2·5	17·4	1·75	20·9	24·9	25×0·9	28·9	32·9	3080
16	7×1·71	5·13	3·0	11·1	16×1·13	13·4	2·5	18·4	1·8	22·0	26·0	25×0·9	30·0	31·0	3390
25	7×2·13	6·4	3·0	12·4	25×1·13	14·7	2·5	19·7	1·85	23·4	27·4	33×0·9	31·4	35·4	3810
35	19×1·53	7·65	3·0	13·7	19×1·53	16·76	2·5	21·8	2·0	25·8	29·8	33×0·9	33·8	37·8	4480
50	19×1·83	9·15	3·0	15·2	19×1·83	18·86	2·5	23·9	2·05	28·0	32·0	33×0·9	36·0	40·0	5150
70	19×2·17	10·85	3·0	16·9	19×2·17	21·24	2·5	26·2	2·15	30·5	34·5	33×0·9	38·5	42·5	6010
95	19×2·53	12·65	3·0	18·7	19×2·53	23·76	2·5	28·8	2·25	33·3	37·3	43×1·0	41·3	45·3	7200
120	19×2·83	14·2	3·0	20·2	19×2·83	25·86	2·5	30·9	2·3	35·5	39·5	43×1·0	43·5	47·5	8090
150	19×3·17	15·85	3·0	21·9	19×3·17	28·24	2·5	33·2	2·4	38·0	42·0	43×1·0	46·0	50·0	9190
185	37×2·52	17·64	3·0	23·6	19×3·52	30·64	2·5	35·7	2·5	40·7	44·7	43×1·0	48·7	52·7	10430
240	37×2·88	20·16	3·0	26·2	19×4·01	34·22	2·5	39·2	2·6	44·4	48·4	55×1·1	52·8	56·8	12400
310	37×3·27	22·89	3·0	28·9	19×4·56	38·02	2·5	43·0	2·75	48·5	52·5	55×1·1	56·9	60·9	14670
355	37×3·5	24·5	3·0	30·5	19×4·88	40·26	2·5	45·3	2·8	50·9	54·9	55×1·1	59·3	63·3	16030
400	37×3·71	25·97	3·75	33·5	19×5·18	43·86	2·5	48·9	2·95	54·8	58·8	55×1·1	63·2	67·2	17960
500	37×4·15	29·05	3·75	36·6	19×5·79	48·2	2·5	53·2	3·0	59·2	63·2	55×1·1	67·6	71·6	20740

TABLE No. 186.—CONSTRUCTIONAL DATA FOR CONCENTRIC CONDUCTOR, IMPREGNATED JUTE CABLE WITH TEST WIRE FOR 2000 VOLTS WORKING PRESSURE. (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor	Conductor Wires		Insulating Jute		Lead Sheath		Dia. over Jute Serving	Steel Tape Armour		Dia. over Jute Serving	Weight of Cable, kilog. per km.
		Number and Diam.	Diam. over Copper	Thickness	Diam. over Jute	Thickness	Dia. over Lead		Dimensions	Dia. over Tape		
10	inner	3×2·06	4·97	5·0	14·97	..	..	..	..	..	..	..
	outer	10×1·13	17·3	2·5	22·3	2·0	26·3	30·3	33×0·9	34·3	38·3	4140
16	inner	3×2·6	6·4	5·0	16·4	..	..	..	..	..	..	..
	outer	16×1·13	18·66	2·5	23·7	2·05	27·8	31·8	33×0·9	35·8	39·8	4500
25	inner	6×2·3	6·9	5·0	16·9	..	..	..	..	..	..	..
	outer	25×1·13	19·16	2·5	24·2	2·1	28·4	32·4	33×0·9	36·4	40·4	4970
35	inner	6×2·75	8·2	5·0	18·2	..	..	..	..	..	..	..
	outer	35×1·13	20·46	2·5	25·5	2·1	29·7	33·7	33×0·9	37·7	41·3	5390
50	inner	6×3·26	9·8	5·0	19·8	..	..	..	..	..	..	..
	outer	18×1·88	23·6	2·5	28·6	2·2	33·0	37·0	43×1·0	41·0	45·0	6410
70	inner	18×2·23	11·15	5·0	21·2	..	..	..	..	..	..	..
	outer	18×2·23	25·66	2·5	30·7	2·3	35·3	39·3	43×1·0	43·3	47·3	7350
95	inner	18×2·59	12·95	5·0	23·0	..	..	..	..	..	..	..
	outer	18×2·59	28·18	2·5	33·2	2·4	38·0	42·0	43×1·0	46·0	50·0	8420
120	inner	18×2·91	14·55	5·0	24·6	..	..	..	..	..	..	..
	outer	18×2·91	30·42	2·5	35·4	2·5	40·4	44·4	43×1·0	48·4	52·4	9440
150	inner	18×3·26	16·3	5·0	26·3	..	..	..	..	..	..	..
	outer	18×3·26	32·82	2·5	37·8	2·55	42·9	46·9	43×1·0	50·9	54·9	10530

TABLE No. 187.—CONSTRUCTIONAL DATA FOR CONCENTRIC CONDUCTOR, IMPREGNATED JUTE CABLE WITH TEST WIRE FOR 3000 VOLTS WORKING PRESSURE. (Dimensions given in mm.)

Area of Conductor, sq. mm.	Conductor	Conductor Wires: Number and Diam.	Conductor Wires: Diam. over Copper	Insulating Jute: Thickness	Insulating Jute: Diam. over Jute	Lead Sheath: Thickness	Lead Sheath: Dia. over Lead	Dia. over Jute Serving	Steel Tape Armour: Dimensions of Tape.	Steel Tape Armour: Dia. over Tape	Dia. over Jute Serving	Weight of Cable, kilog. per km.
10	inner	3×2·06	4·97	6·25	17·5	..	..	..	..	..	..	..
	outer	10×1·13	19·76	3·75	27·3	2·15	31·6	35·6	33×0·9	39·6	43·6	5290
16	inner	3×2·6	6·4	6·25	18·9	..	..	..	..	..	..	..
	outer	16×1·13	21·16	3·75	28·7	2·2	33·1	37·1	43×1·0	41·1	45·1	5870
25	inner	6×2·3	6·9	6·25	19·4	..	..	..	..	..	..	..
	outer	25×1·13	21·7	3·75	29·2	2·25	33·7	37·7	43×1·0	41·7	45·7	6360
35	inner	6×2·75	8·2	6·25	20·7	..	..	..	..	..	..	..
	outer	35×1·13	23·0	3·75	30·5	2·3	35·1	39·1	43×1·0	43·1	47·1	6940
50	inner	6×3·26	9·8	6·25	22·3	..	..	..	..	..	..	..
	outer	18×1·88	26·1	3·75	33·6	2·4	38·4	42·4	43×1·0	46·4	50·4	7780
70	inner	18×2·23	11·15	6·25	23·7	..	..	..	..	..	..	..
	outer	18×2·23	28·2	3·75	35·7	2·5	40·7	44·7	43×1·0	48·7	52·7	8840
95	inner	18×2·59	12·95	6·25	25·5	..	..	..	..	..	..	..
	outer	18×2·59	30·7	3·75	38·2	2·55	43·3	47·3	55×1·1	51·7	55·7	9990
120	inner	18×2·91	14·55	6·25	27·05	..	..	..	..	..	..	..
	outer	18×2·91	32·9	3·75	40·4	2·65	45·7	49·7	55×1·1	54·1	58·1	11230
150	inner	18×3·26	16·3	6·25	28·8	..	..	..	..	..	..	..
	outer	18×3·26	35·3	3·75	42·8	2·75	48·3	52·3	55×1·1	56·7	60·7	12300

TABLE No. 188.—CONSTRUCTIONAL DATA FOR TRIPLE CONCENTRIC, IMPREGNATED JUTE CABLE FOR 700 VOLTS WORKING PRESSURE. (Dimensions in mm.)

Area of each Conductor sq. mm.	Inner Conductor		Insulating Jute		Middle Conductor		Insulating Jute		Outer Conductor		Insulating Jute		Lead Sheath		Diam. over Jute Serving	Steel Tape Armour		Diam. over Jute Serving	Weight of Cable, kilog. per km.
	No. and Diam.	Diam. over	Thickness	Diam. over	No. and Diam.	Diam. over	Thickness	Diam. over	No. and Diam.	Diam. over	Thickness	Diam. over	Thickness	Diam over		Dimensions of Tape	Diam. over		
10	7×1·35	4·1	2·5	9·1	10×1·13	11·4	2·5	16·4	10×1·13	18·7	2·5	23·7	2·05	27·8	31·8	33×0·9	35·4	39·4	5030
16	7×1·71	5·1	2·5	10·1	16×1·13	12·4	2·5	17·4	16×1·13	19·7	2·5	24·7	2·1	28·9	32·9	33×0·9	36·5	40·5	5900
25	7×2·13	6·4	2·5	11·4	25×1·13	13·7	2·5	18·7	25×1·13	21·0	2·5	26·0	2·15	30·3	34·3	33×0·9	37·9	41·9	6200
35	19×1·53	7·7	2·5	12·7	32×1·18	15·1	2·5	20·1	32×1·18	22·4	2·5	27·4	2·2	31·8	35·8	33×0·9	39·4	43·4	6600
50	19×1·83	9·2	2·5	14·2	33×1·4	17·0	2·5	22·0	33×1·4	24·8	2·5	29·8	2·3	34·4	38·4	43×1·0	42·4	46·4	7600
70	19×2·17	10·9	2·5	15·9	31×1·7	19·3	2·5	24·3	31×1·7	27·7	2·5	32·7	2·4	37·5	41·5	43×1·0	45·5	49·5	8900
95	19×2·53	12·7	2·5	17·7	29×2·05	21·8	2·5	26·8	29×2·05	30·9	2·5	35·9	2·5	40·9	44·9	43×1·0	48·9	52·9	10400
120	19×2·83	14·2	2·5	19·2	27×2·4	24·0	2·5	29·0	27×2·4	33·8	2·5	38·8	2·6	44·0	48·0	55×1·1	52·4	56·4	11800
150	19×3·17	15·9	2·5	20·9	27×2·66	26·2	2·5	31·2	27×2·66	36·5	2·5	41·5	2·7	46·9	50·9	55×1·1	55·3	59·3	13600
185	19×3·52	17·6	2·5	22·6	25×3·07	28·7	2·5	33·7	25×3·07	39·8	2·5	44·8	2·8	50·4	54·4	55×1·1	58·8	62·8	15400
210	19×3·75	18·8	2·5	23·8	26×3·2	30·2	2·5	35·2	26×3·2	41·6	2·5	46·6	2·85	52·3	56·3	55×1·1	60·7	64·7	16300
240	19×4·01	20·1	2·5	25·1	23×3·65	32·4	2·5	37·4	23×3·65	44·7	2·5	49·7	3·0	55·7	59·7	55×1·1	64·1	68·1	18000
310	37×3·27	22·9	2·5	27·9	24×4·05	36·0	2·5	41·0	24×4·05	49·1	2·5	54·1	3·0	60·1	64·1	55×1·1	68·5	72·5	20700

Table No. 189.—Details of Telegraph Cable. Conductor, 1·5 mm. Diam., Insulated with Two Layers of Impregnated Jute Yarn.

Electrostatic Capacity = 0·38 microfarads per mile.

Number of Cores	Diam. over Laid up Cores, mm.	Lead Thickness in mm.		Segmental Strip Armour	
		For Plain Lead Cable	For Armoured Cable	Dimensions in mm.	Number of Strips
4	7·2	1·6	1·5	4·0×3·4×1·4	12
7	9·0	1·7	1·6	4·0×3·4×1·4	13
14	13·2	1·8	1·7	4·9×4·3×1·7	13
28	19·2	2·0	2·0	4·9×4·3×1·7	18
56	26·1	2·5	2·4	4·9×4·3×1·7	23
112	37·2	3·0	2·8	6·2×5·0×1·7	24

TABLE NO. 190.—DETAILS OF BRAIDED RUBBER CABLES 300 AND 600 MEGOHM GRADE.

(Dimensions given in mm.; weights in kilog. per km.; prices in shillings per km.)

Conductor		Diam.		Rubber			Weight of Rubber		Prepared Tape		Braiding			Weight of Braiding Compound	Wages		
Strand, L.S.W.G.	Area, sq. mm.	Single Wire	Strand	Thickness	Diam. over	Area of Cross Section	Para	Compound, sp. gr. = 1·6	Diam. over	Weight	Material	Diam. over	Weight		Stranding and Winding	Rubber Covering	Braiding
1/20	0·66	0·914	0·914	0·9	2·7	5·09	0·69	7·04	3·3	2·4	cotton	4·3	3·1	4·8	0·50	5·60	3·1
1/19	0·82	1·016	1·02	0·9	2·8	5·37	0·76	7·4	3·4	2·5	,,	4·4	3·2	4·9	0·50	5·70	3·1
1/18	1·17	1·219	1·22	0·9	3·0	5·94	0·88	8·1	3·6	2·6	,,	4·6	3·5	5·2	0·50	5·80	3·1
1/17	1·58	1·422	1·42	0·9	3·2	6·50	1·0	8·8	3·8	2·8	,,	4·8	3·6	5·3	0·5	6·00	3·1
1/16	2·09	1·626	1·62	0·9	3·4	7·07	1·13	9·5	4·0	3·0	,,	5·0	3·8	5·5	0·5	6·25	3·1
1/15	2·63	1·828	1·83	0·9	3·6	7·64	1·26	10·2	4·2	3·1	,,	5·2	4·0	5·8	0·5	6·40	3·1
1/14	3·24	2·032	2·03	1·0	4·0	9·43	1·38	12·9	4·6	3·5	,,	6·0	5·8	8·4	0·5	7·00	3·1
1/13	4·30	2·336	2·34	1·0	4·3	10·37	1·57	14·1	4·9	3·7	,,	6·3	6·2	8·9	0·5	8·25	3·5
1/12	5·47	2·641	2·64	1·0	4·6	11·31	1·76	15·3	5·2	3·9	,,	6·6	8·3	10·3	0·5	8·35	2·35
1/11	6·84	2·946	2·95	1·0	4·95	12·567	2·01	16·8	5·6	4·3	,,	7·0	7·1	9·9	0·5	8·50	3·5
1/10	8·3	3·251	3·25	1·0	5·25	13·51	2·2	18·1	5·9	4·5	,,	7·3	7·4	10·3	0·5	8·75	3·5
3/25	0·6	0·508	1·09	0·9	2·9	5·85	0·82	8·05	3·5	2·6	,,	4·5	3·3	5·0	2·0	5·80	3·1
3/23	0·88	0·609	1·31	0·9	3·1	6·49	0·94	8·8	3·7	2·7	,,	4·7	3·5	5·2	2·0	6·00	3·1
3/22	1·19	0·711	1·53	0·9	3·3	7·14	1·07	9·7	3·9	2·9	,,	4·9	3·7	5·4	2·0	6·25	3·1
3/20	1·97	0·914	1·95	1·0	4·0	10·18	1·54	13·9	4·6	3·5	,,	6·0	5·8	8·4	2·0	8·25	3·1
3/18	3·5	1·219	2·63	1·0	4·6	12·37	1·76	17·0	5·2	3·9	,,	6·6	8·3	10·3	2·0	8·60	2·35
7/25	1·42	0·508	1·54	0·9	3·4	7·66	1·07	10·55	4·0	3·0	,,	5·0	3·8	5·5	2·35	6·40	3·1
7/24	1·72	0·558	1·67	0·9	3·5	7·81	1·19	10·6	4·1	3·1	,,	5·1	3·9	5·6	2·30	6·40	3·1
7/23	2·05	0·609	1·83	0·9	3·6	8·14	1·25	11·0	4·2	3·1	,,	5·2	4·0	5·8	2·25	6·50	3·1
7/22	2·78	0·711	2·13	1·0	4·1	10·44	1·45	14·4	4·7	3·5	,,	6·1	5·9	8·7	2·20	8·30	3·1
7/21	3·63	0·813	2·44	1·0	4·4	11·59	1·63	15·9	5·0	3·8	,,	6·4	6·3	9·1	2·15	8·50	3·5
7/20	4·59	0·914	2·74	1·0	4·7	12·77	1·82	17·5	5·3	4·0	,,	6·7	8·3	10·3	2·20	8·75	2·35
7/19	5·72	1·02	3·06	1·0	5·0	13·6	2·07	18·45	5·6	4·3	,,	7·0	7·1	9·9	2·30	9·00	3·5
7/18	8·18	1·22	3·66	1·1	5·85	18·74	2·45	26·1	6·5	5·0	,,	7·9	8·0	11·0	2·40	11·00	6·0

TABLE No. 190.—DETAILS OF BRAIDED RUBBER CABLES 300 AND 600 MEGOHM GRADE—*continued.*

Conductor		Diam.		Rubber			Weight of Rubber		Prepared Tape		Braiding			Weight of Braiding Compound	Wages		
Strand, L.S.W.G.	Area, sq. mm.	Single Wire	Strand	Thickness	Diam. over	Area of Cross Section	Para	Compound, sp. gr. = 1·6	Diam. over	Weight	Material	Diam. over	Weight		Stranding and Winding	Rubber Covering	Braiding
7/17	11·09	1·42	4·26	1·2	6·65	23·64	2·83	33·3	7·3	5·6	Cotton	8·7	9·2	12·2	2·50	12·00	7·0
7/16	14·6	1·625	4·88	1·35	7·6	30·29	3·21	43·3	8·2	6·3	,,	9·6	10·3	13·6	2·50	15·00	7·0
7/15	18·4	1·83	5·49	1·45	8·4	36·42	3·58	52·5	9·0	7·0	,,	10·4	11·3	14·7	2·60	19·00	7·0
7/14	22·66	2·03	6·1	1·6	9·3	44·55	3·96	64·9	9·9	7·7	,,	11·3	15·7	19·6	2·80	22·0	6·2
7/13	30·1	2·336	7·0	1·75	10·5	55·81	4·52	82·0	11·1	8·6	Jute	15·1	46·0	37–37	2·90	26·0	25·0
7/12	38·31	2·64	7·9	1·9	11·7	68·3	5·09	101·1	12·3	9·6	,,	16·3	50·0	40 40	3·00	30·0	28·0
19/20	12·47	0·914	4·57	1·3	7·2	26·6	3·02	37·7	7·8	6·0	Cotton	9·2	9·9	13·1	3·60	12·0	7·0
19/19	15·50	1·02	5·08	1·4	7·9	31·66	3·33	45·3	8·5	6·6	,,	9·9	10·7	14·0	3·70	16·0	7·0
19/18	22·20	1·22	6·1	1·6	9·3	43·09	3·95	62·6	9·9	7·7	,,	11·3	15·7	19·6	3·80	21·0	6·2
19/17	30·10	1·42	7·1	1·8	10·7	56·27	4·59	82·7	11·3	8·8	Jute	15·3	46·0	37–37	3·90	27·0	25·0
19/16	39·65	1·63	8·12	1·95	12·0	69·30	5·22	102·5	12·6	9·8	,,	16·6	50·0	40–40	4·00	30·0	28·0
19/15	49·98	1·83	9·15	2·15	13·5	86·65	5·90	129·2	14·1	11·1	,,	18·1	56·0	45–45	5·0	47·0	30·0
19/14	61·5	2·03	10·1	2·35	14·8	103·93	6·47	155·9	15·4	12·1	,,	19·4	60·0	48 48	6·0	62·0	32·0
19/13	81·7	2·34	11·6	2·6	16·8	131·85	7·42	199·1	17·4	13·1	,,	21·4	66·0	53–53	8·0	65·0	34·0
19/12	104·0	2·64	13·2	2·9	19·0	167·23	8·42	254·1	19·6	15·5	,,	23·6	73·0	59 59	11·0	82·0	36·0
37/20	24·26	0·914	6·4	1·6	9·6	44·39	4·14	64·4	10·2	7·9	,,	14·2	42·0	34 34	14·0	24·0	22·0
37/19	30·23	1·02	7·14	1·5	10·1	45·68	4·59	65·7	10·7	8·3	,,	14·7	45·0	36 36	13·5	25·0	24·0
37/18	43·25	1·22	8·54	2·0	12·5	73·36	5·47	108·6	13·1	10·3	,,	17·1	52·0	42–42	13·0	33·0	29·0
37/17	58·6	1·42	9·94	2·25	14·4	95·89	6·34	143·3	15·0	11·8	,,	19·0	58·0	47–47	12·8	58·0	30·0
37/16	77·2	1·63	11·3	2·55	16·4	124·26	7·22	187·3	17·0	13·4	,,	21·0	65·0	52–52	12·5	66·0	34·0
37/15	97·3	1·83	12·8	2·8	18·4	154·20	8·17	233·7	19·0	14·9	,,	23·0	72·0	58 58	13·0	82·0	36·0
37/14	119·75	2·03	14·2	3·1	20·4	189·05	9·05	288·0	21·0	16·6	,,	25·0	78·0	63–63	13·3	96·0	37·0
37/13	159·12	2·33	16·3	3·5	23·3	244·83	10·37	375·1	23·9	18·9	,,	27·9	87·0	70 70	17·0	120·0	40·0
37/12	202·5	2·64	18·4	3·9	26·2	307·83	11·70	473·8	26·8	21·2	,,	30·8	97·0	78–78	21·0	142·0	45·0

The Jute Braided Cables are first run through Stockholm tar and then compounded; the first weight given is the weight of Stockholm tar, the second the weight of compound.

TABLE No. 191.—DETAILS OF BRAIDED RUBBER CABLES 2500 MEGOHM GRADE.

(Dimensions given in mm.; weights in kilog. per km.)

Conductor		Diam.		Rubber			Weight of Rubber		Prepared Tape		Braiding			Weight of Braiding Compound	Wages, Shillings per km.		
Strand, L.S.W.G.	Area, sq. mm.	Single Wire	Strand	Thickness	Diam. over	Area of Cross Section	Para	Compound, sp. gr. = 1·5	Diam. over	Weight	Material	Diam. over	Weight		Stranding and Winding	Rubber Covering	Braiding
1/20	0·66	0·914	0·914	1·0	2·9	5·97	0·69	7·9	3·5	2·6	Cotton	4·5	3·3	5·0	0·5	5·70	3·1
1/19	0·82	1·016	1·02	1·0	3·0	6·28	0·76	8·3	3·6	2·7	,,	4·6	3·4	5·1	0·5	5·80	3·1
1/18	1·17	1·219	1·22	1·0	3·2	7·16	0·88	9·4	3·8	2·8	,,	4·8	3·6	5·3	0·5	6·10	3·1
1/17	1·58	1·422	1·42	1·0	3·4	8·08	1·0	10·6	4·0	3·0	,,	5·0	3·8	5·5	0·5	6·40	3·1
1/16	2·09	1·626	1·62	1·0	3·6	9·05	1·13	11·9	4·2	3·1	,,	5·2	4·0	5·8	0·5	6·80	3·1
1/15	2·63	1·828	1·83	1·0	3·8	10·08	1·26	13·3	4·4	3·3	,,	5·4	4·2	6·0	0·5	7·30	3·1
1/14	3·24	2·032	2·03	1·0	4·0	11·19	1·38	14·7	4·6	3·5	,,	6·0	5·8	8·4	0·5	8·30	3·1
1/13	4·3	2·336	2·34	1·0	4·3	12·95	1·57	17·1	4·9	3·7	,,	6·3	6·2	8·9	0·5	8·60	3·5
1/12	5·47	2·641	2·64	1·0	4·6	14·86	1·76	19·65	5·2	3·9	,,	6·6	8·3	10·3	0·5	8·80	2·35
1/11	6·84	2·946	2·95	1·0	5·0	17·63	2·01	23·43	5·6	4·2	,,	7·0	7·1	9·9	0·5	10·0	3·5
1/10	8·3	3·251	3·25	1·05	5·4	20·7	2·2	27·75	6·0	4·6	,,	7·4	7·7	10·6	0·5	11·0	3·5
3/25	0·6	0·508	1·09	1·0	3·1	6·79	0·82	8·95	3·7	2·8	,,	4·7	3·5	5·2	2·0	6·0	3·1
3/23	0·88	0·609	1·31	1·0	3·3	7·49	0·94	9·8	3·9	2·9	,,	4·9	3·7	5·4	2·0	6·4	3·1
3/22	1·19	0·711	1·53	1·0	3·5	8·21	1·07	10·7	4·1	3·0	,,	5·1	3·9	5·6	2·0	6·5	3·1
3/20	1·97	0·914	1·95	1·0	4·0	10·18	1·54	13·0	4·6	3·4	,,	6·0	5·8	8·4	2·0	7·3	3·1
3/18	3·5	1·219	2·63	1·0	4·6	12·37	1·76	15·9	5·2	3·9	,,	6·6	8·3	10·3	2·0	8·4	2·35
7/25	1·42	0·508	1·54	1·0	3·5	8·2	1·07	10·7	4·1	3·0	,,	5·1	3·9	5·6	2·35	6·4	3·1
7/24	1·72	0·558	1·67	1·0	3·7	8·94	1·19	11·6	4·3	3·2	,,	5·3	6·7	8·3	2·30	6·8	2·30
7/23	2·05	0·609	1·83	1·0	3·8	9·3	1·25	12·1	4·4	3·3	,,	5·4	4·2	6·0	2·25	6·9	3·1
7/22	2·78	0·711	2·13	1·0	4·1	10·43	1·45	13·5	4·7	3·4	,,	6·1	5·9	8·7	2·20	7·5	3·1
7/21	3·63	0·813	2·44	1·0	4·4	11·59	1·63	14·94	5·0	3·8	,,	6·4	6·3	9·1	2·15	8·3	3·5
7/20	4·59	0·914	2·74	1·0	4·7	12·77	1·82	16·4	5·3	4·0	,,	6·7	8·3	10·3	2·20	8·6	2·35
7/19	5·72	1·02	3·06	1·0	5·1	14·39	2·07	18·5	5·7	4·3	,,	7·1	7·1	10·0	2·30	8·9	3·5
7/18	8·18	1·22	3·66	1·15	6·0	19·67	2·45	25·8	6·6	5·0	,,	8·0	8·5	11·5	2·40	10·5	6·5

TABLE NO. 191.—DETAILS OF BRAIDED RUBBER CABLES 2500 MEGOHM GRADE—*continued.*

(Dimensions given in mm.; weights in kilog. per km.)

Conductor		Diam.		Rubber			Weight of Rubber		Prepared Tape		Braiding			Weight of Braiding Compound	Wages, Shillings per km.		
Strand, L.S.W.G.	Area, sq. mm.	Single Wire	Strand	Thickness	Diam. over	Area of Cross Section	Para	Compound, sp. gr. = 1·5	Diam. over	Weight	Material	Diam. over	Weight		Stranding and Winding	Rubber Covering	Braiding
7/17	11·09	1·42	4·26	1·25	6·8	24·7	2·83	32·8	7·4	5·7	Cotton	8·8	9·3	12·5	2·5	12·0	7·0
7/16	14·6	1·625	4·88	1·4	7·7	31·49	3·21	42·4	8·3	6·4	"	9·7	13·0	16·2	2·5	14·6	6·2
7/15	18·4	1·83	5·49	1·45	8·4	36·42	3·58	49·3	9·0	7·0	"	10·4	11·3	14·7	2·6	18·0	7·0
7/14	22·66	2·03	6·1	1·5	9·1	41·66	3·96	56·6	9·7	7·5	"	11·1	15·2	19·0	2·8	20·0	8·0
7/13	30·1	2·34	7·0	1·6	10·2	50·93	4·52	69·6	10·8	8·4	Jute	14·8	44·0	36–36	2·9	24·0	24·0
7/12	38·31	2·64	7·9	1·7	11·3	61·08	5·09	84·0	11·9	9·3	"	15·9	48·0	39–39	3·0	26·0	28·0
19/20	12·47	0·914	4·57	1·3	7·2	26·6	3·02	35·4	7·8	6·0	Cotton	9·2	9·9	13·1	3·6	11·0	7·0
19/19	15·5	1·02	5·08	1·4	7·9	31·66	3·33	42·5	8·5	6·6	"	9·9	10·7	14·0	3·7	15·0	7·0
19/18	22·2	1·22	6·1	1·5	9·1	40·2	3·95	54·4	9·7	7·5	"	11·1	15·2	19·0	3·8	20·0	8·0
19/17	30·1	1·42	7·1	1·65	10·4	51·31	4·59	70·1	11·0	8·6	Jute	15·0	46·0	37–37	3·9	25·0	25·0
19/16	39·65	1·63	8·12	1·75	11·6	61·89	5·22	85·0	12·2	9·5	"	16·2	50·0	40–40	4·0	28·0	28·0
19/15	49·98	1·83	9·15	1·85	12·9	74·22	5·9	102·5	13·5	10·6	"	17·5	54·0	44–44	5·0	30·0	30·0
19/14	61·5	2·03	10·1	2·0	14·1	88·07	6·47	122·4	14·7	11·5	"	18·7	58·0	47–47	6·0	42·0	32·0
19/13	81·7	2·34	11·6	2·15	15·9	108·76	7·42	152·0	16·5	13·0	"	20·5	64·0	52–52	8·0	60·0	34·0
19/12	104·0	2·64	13·2	2·35	17·9	135·35	8·42	190·4	18·5	14·6	"	22·5	70·0	56–56	11·0	65·0	35·0
37/20	24·26	0·914	6·4	1·55	9·5	42·9	4·14	58·14	10·1	7·8	"	14·1	43	35–35	14·0	20·0	24·0
37/19	30·23	1·02	7·14	1·65	10·4	50·5	4·59	68·9	11·0	8·6	"	15·0	46	37–37	13·5	24·0	25·0
37/18	43·25	1·22	8·54	1·8	12·1	65·62	5·47	90·2	12·7	9·9	"	16·7	51	41–41	13·0	29·0	28·0
37/17	58·6	1·42	9·94	1·95	13·8	82·61	6·34	112·9	14·4	11·3	"	18·4	56	45–45	12·8	45·0	30·0
37/16	77·2	1·63	11·3	2·1	15·5	101·69	7·22	141·7	16·1	12·4	"	20·1	62	50–50	12·5	55·0	34·0
37/15	97·3	1·83	12·8	2·3	17·4	125·89	8·17	176·6	18·0	14·2	"	22·0	68	55–55	13·0	62·0	36·0
37/14	119·75	2·03	14·2	2·45	19·1	148·72	9·05	209·5	19·7	15·5	"	23·7	74	59–59	13·3	68·0	37·0
37/13	159·12	2·33	16·3	2·7	21·7	188·34	10·37	267·0	22·3	17·6	"	26·3	83	67–67	17·0	85·0	38·0
37/12	202·5	2·64	18·4	2·95	24·3	232·47	11·7	331·15	24·9	19·7	"	28·9	90	72–72	21·0	110·0	42·0

TABLE No. 192.—DETAILS OF RUBBER (OKONITE) CORES FOR 500 VOLTS WORKING PRESSURE. (RUBBER APPLIED BY FORCING MACHINE.)
Dimensions given in mm.

Area of Conductor, sq. mm.	Number and Diam. of Wires	Diam. over Conductor	Rubber		Area of Rubber Section, sq. mm.	Weight of Rubber in kilog. per km., sp. gr. = 1·6	Wages, Shillings per km.	
			Thickness	Diam. over Rubber			Conductor	Rubber Covering
1·0	1×1·13	1·1	1·0	3·1	6·59	10·5	0·5	6·75
1·5	1×1·4	1·4	1·0	3·4	7·54	12·1	0·5	7·25
2·5	1×1·8	1·8	1·0	3·8	8·79	14·1	0·5	8·25
4·0	1×2·25	2·3	1·0	4·3	10·26	16·4	0·5	9·25
6·0	1×2·76	2·8	1·1	5·0	13·47	21·6	0·5	11·00
10·0	1×3·57	3·6	1·2	6·0	18·09	28·9	0·5	15·00
1·0	7×0·43	1·3	1·0	3·3	7·79	12·8	2·35	8·25
1·5	7×0·52	1·6	1·0	3·6	8·57	13·7	2·25	8·50
2·5	7×0·67	2·0	1·0	4·0	10·05	16·1	2·15	8·75
4·0	7×0·85	2·6	1·05	4·7	13·10	21·0	2·00	12·00
6·0	7×1·05	3·2	1·15	5·6	18·19	29·1	2·30	11·00
10·0	7×1·35	4·1	1·25	6·6	23·65	37·8	2·50	14·50
16·0	7×1·71	5·1	1·35	7·8	31·44	50·3	2·60	18·50
25·0	7×2·13	6·3	1·5	9·3	42·99	68·8	2·80	25·00
35	19×1·53	7·7	1·7	11·1	59·51	95·2	3·90	30·00
50	19×1·83	9·2	1·9	13·0	76·23	122·0	5·60	45·00
70	19×2·17	10·8	2·05	14·9	96·51	154·4	7·80	57·5
95	19×2·53	12·7	2·2	17·1	121·99	195·1	10·50	72·0
120	37×2·03	14·2	2·35	18·9	142·77	228·4	13·30	85·0
150	37×2·27	15·9	2·5	20·9	170·33	272·5	16·70	98·0
185	37×2·52	17·6	2·6	22·8	196·63	314·6	20·60	115
210	61×2·09	18·8	2·7	24·2	216·20	345·8	23·40	125
240	61×2·24	20·2	2·85	25·9	244·84	391·7	26·70	140
280	61×2·42	21·8	2·95	27·7	274·17	438·4	31·10	160
310	91×2·08	22·9	3·05	29·0	289·84	463·7	41·30	165
355	91×2·23	24·5	3·15	30·8	321·77	514·7	47·30	170
400	91×2·37	26·1	3·25	32·6	353·18	564·8	53·30	180
500	127×2·26	29·4	3·5	36·4	429·7	687·2	66·60	195

TABLE No. 193.—DETAILS OF RUBBER (OKONITE) CORES FOR 1000 VOLTS WORKING PRESSURE. (RUBBER APPLIED BY FORCING MACHINE.)
Dimensions given in mm.

Area of Conductor, sq. mm.	Number and Diam. of Wires	Diam. over Conductor	Rubber		Area of Rubber Section, sq. mm.	Weight of Rubber in kilog. per km. sp. gr. = 1·6	Wages, Shillings per km.	
			Thickness	Diam. over Rubber			Conductor	Rubber Covering
1·0	1×1·13	1·1	1·3	3·7	9·80	15·7	0·50	6·75
1·5	1×1·4	1·4	1·3	4·0	11·02	17·6	0·50	7·25
2·5	1×1·8	1·8	1·3	4·4	12·66	20·3	0·50	8·25
4·0	1×2·25	2·3	1·3	4·9	14·70	23·5	0·50	9·25
6·0	1×2·76	2·8	1·4	5·6	18·47	29·5	0·50	11·0
10·0	1×3·57	3·6	1·5	6·6	24·04	38·5	0·50	15·0
1·0	7×0·43	1·3	1·3	3·9	10·89	17·4	2·35	8·25
1·5	7×0·52	1·6	1·3	4·2	12·24	19·6	2·25	8·50
2·5	7×0·67	2·0	1·3	4·6	14·11	22·6	2·15	8·75
4·0	7×0·85	2·6	1·35	5·3	17·82	28·5	2·00	12·0
6·0	7×1·05	3·2	1·45	6·1	22·79	36·5	2·30	11·0
10	7×1·35	4·1	1·55	7·2	30·15	48·2	2·50	14·5
16	7×1·71	5·1	1·65	8·4	39·08	62·5	2·60	18·5
25	7×2·13	6·3	1·8	9·9	52·04	83·2	2·80	25·0
35	19×1·53	7·7	2·0	11·7	70·26	112·4	3·90	30·0
50	19×1·83	9·2	2·2	13·6	88·77	142·0	5·60	45·0
70	19×2·17	10·8	2·35	15·5	110·83	177·3	7·80	57·5
95	19×2·53	12·7	2·5	17·7	138·38	221·4	10·5	72·0
120	37×2·03	14·2	2·65	19·5	160·87	257·3	13·3	85·0
150	37×2·27	15·9	2·8	21·5	190·31	304·4	16·7	98·0
185	37×2·52	17·6	2·9	23·4	218·40	349·4	20·6	115
210	61×2·09	18·8	3·0	24·8	238·78	382·0	23·4	125
240	61×2·24	20·2	3·15	26·5	269·54	431·2	26·7	140
280	61×2·42	21·8	3·25	28·3	300·56	480·8	31·1	160
310	91×2·08	22·9	3·35	29·6	317·45	508·0	41·3	165
355	91×2·23	24·5	3·45	31·4	350·11	560·1	47·3	170
400	91×2·37	26·1	3·55	33·2	384·19	614·6	53·3	180
500	127×2·26	29·4	3·8	37·0	464·22	742·3	66·6	195

Table No. 194.—Constructional Data for Single Conductor, Rubber-covered Cable for 1000 to 2000 Volts Working Pressure.
(Weights in kilog. per km.)

Conductor			Rubber			Weight of Rubber			Weight of Prepared Tape	Wages, Shillings per km.	
Area, sq. mm.	Number and Diam. of Wires, mm.	Diam. over in mm.	Radial Thickness, mm.	Diam. over, mm.	Area of Rubber, sq. mm.	Para	Compound for sp. gr.=1·5	Compound for sp. gr. =1·6		Winding and Stranding	Rubber Covering
1·0	1×1·13	1·1	1·3	3·7	9·80	0·8	13·5	14·4	3·2	0·5	6·75
1·5	1×1·4	1·4	1·3	4·0	11·02	1·0	15·0	16·0	3·4	0·5	7·25
2·5	1×1·8	1·8	1·3	4·4	12·66	1·3	17·0	18·2	3·8	0·5	8·25
4·0	1×2·25	2·25	1·3	4·9	14·70	1·6	19·65	21·0	4·2	0·5	9·25
6·0	1×2·76	2·76	1·4	5·6	18·47	1·9	24·9	26·5	4·7	0·5	11·00
10·0	1×3·57	3·57	1·5	6·6	24·04	2·4	32·5	34·6	6·1	0·5	15·00
1·0	7×0·43	1·3	1·3	3·9	10·89	0·9	15·0	16·0	3·4	2·35	8·25
1·5	7×0·52	1·6	1·3	4·2	12·24	1·1	16·7	17·8	3·4	2·25	8·50
2·5	7×0·67	2·0	1·3	4·6	14·11	1·4	19·1	20·3	3·9	2·15	8·75
4·0	7×0·85	2·6	1·35	5·3	17·82	1·8	24·0	25·6	4·5	2·00	12·0
6·0	7×1·05	3·2	1·45	6·1	22·79	2·1	31·0	33·1	5·1	2·30	11·0
10	7×1·35	4·1	1·55	7·2	30·15	2·7	41·2	43·9	6·0	2·5	14·5
16	7×1·71	5·1	1·65	8·4	39·08	3·3	53·7	57·2	7·0	2·6	18·5
25	7×2·13	6·4	1·8	10·0	52·81	4·1	73·1	77·9	8·2	2·8	25·0
35	19×1·53	7·7	2·0	11·7	68·00	5·0	94·5	100·8	9·6	3·9	30·0
50	19×1·83	9·2	2·2	13·6	88·77	5·9	124·3	132·6	11·1	5·6	45·0
70	19×2·17	10·9	2·35	15·6	111·82	7·2	156·9	167·4	12·7	7·8	57·5
95	19×2·53	12·7	2·5	17·7	138·38	8·1	195·4	208·4	14·4	10·5	72·0
120	37×2·03	14·2	2·65	19·5	160·87	9·0	227·8	243·0	15·8	13·3	85·0
150	37×2·27	15·9	2·8	21·5	190·31	10·1	270·3	288·3	17·4	16·7	98·0
185	37×2·52	17·6	2·9	23·4	218·40	11·2	310·8	331·5	19·0	20·6	115
210	61×2·09	18·8	3·0	24·8	238·78	11·9	340·3	363·0	20·1	23·4	125
240	61×2·24	20·2	3·15	26·5	269·54	12·8	385·0	410·7	21·4	26·7	140
280	61×2·42	21·8	3·25	28·3	300·56	13·8	430·1	458·8	22·9	31·1	160
310	91×2·08	22·9	3·35	29·6	317·45	14·5	454·4	484·7	23·9	41·3	165
355	91×2·23	24·5	3·45	31·4	350·11	15·5	501·9	535·4	25·4	47·3	170
400	91×2·37	26·1	3·55	33·2	384·19	16·5	551·5	588·3	26·8	53·3	180
500	127×2·26	29·4	3·8	37·0	464·22	18·6	668·4	713·0	29·8	66·6	195

TABLE No. 195.—DETAILS OF BRAIDED RUBBER CABLES FOR 1000 TO 2000 VOLTS WORKING PRESSURE.
(Dimensions given in mm.; weights in kilog. per km.)

Conductor		Diameter		Rubber			Weight of Rubber		Prepared Tape		Braiding			Weight of Compound		Wages, shillings per km.		
Strand L.S.W.G.	Area, sq. mm.	Single Wire	Strand	Thickness	Diam. over	Area of Cross Section, sq. mm.	Para	Compound, sp. gr. = 1·5	Dia. over	Wght.	Material	Diam. over	Wght.	Stockholm Tar	Cable Compound	Winding and Stranding	Rubber Covering	Braiding
1/10	8·3	3·251	3·25	1·15	5·5	15·21	2·2	19·5	6·1	4·7	Cotton	7·5	7·65	..	10·6	0·5	9·25	3·50
1/11	6·84	2·946	2·94	1·15	5·2	14·63	1·95	19·0	5·8	4·4	,,	7·2	7·40	..	10·3	0·5	8·75	3·50
1/12	5·47	2·641	2·64	1·10	4·8	12·79	1·76	16·5	5·4	4·1	,,	6·8	6·80	..	9·6	0·5	8·50	3·50
1/13	4·3	2·336	2·34	1·05	4·4	11·05	1·57	14·2	5·0	3·8	,,	6·4	6·30	..	9·05	0·5	8·25	3·50
1/14	3·24	2·032	2·03	1·0	4·0	9·43	1·38	12·1	4·6	3·5	,,	6·0	5·80	..	8·4	0·5	6·75	3·10
1/15	2·63	1·828	1·83	1·0	3·8	8·8	1·26	11·3	4·4	3·3	,,	5·4	4·15	..	5·95	0·5	6·50	3·10
1/16	2·09	1·6256	1·62	0·95	3·5	7·61	1·13	9·7	4·1	3·1	,,	5·1	3·85	..	5·6	0·5	6·25	3·10
1/17	1·58	1·4224	1·42	0·95	3·3	7·01	1·01	9·0	3·9	2·9	,,	4·9	3·70	..	5·4	0·5	6·00	3·1
1/18	1·17	1·219	1·22	0·95	3·1	6·42	0·88	8·3	3·7	2·7	,,	4·7	3·50	..	5·2	0·5	5·80	3·1
1/19	0·82	1·016	1·02	0·90	2·8	5·37	0·76	6·9	3·4	2·5	,,	4·4	3·20	..	4·85	0·5	5·60	3·1
1/20	0·66	0·914	0·914	0·90	2·7	5·09	0·69	6·6	3·3	2·4	,,	4·3	3·10	..	4·75	0·5	5·50	3·1
1/21	0·52	0·812	0·813	0·90	2·6	4·81	0·63	6·3	3·2	2·3	,,	4·2	3·00	..	4·6	0·5	5·40	3·1
1/22	0·4	0·711	0·711	0·70	2·1	3·08	0·57	3·8	2·7	1·9	,,	3·7	2·55	..	4·05	0·5	5·00	3·1
3/20	1·97	0·914	1·95	1·0	4·0	10·18	1·54	13·0	4·6	3·5	,,	6·0	5·80	..	8·4	2·0	6·75	3·1
3/22	1·19	0·711	1·53	0·95	3·4	7·67	1·07	9·9	4·0	3·0	,,	5·0	3·80	..	5·5	2·0	6·50	3·1
3/23	0·88	0·609	1·31	0·95	3·2	6·98	0·94	9·1	3·8	2·8	,,	4·8	3·60	..	5·3	2·0	6·00	3·1
3/25	0·6	0·508	1·095	0·9	2·9	5·85	0·82	7·5	3·5	2·6	,,	4·5	3·30	..	4·95	2·0	5·80	3·1
7/14	22·66	2·03	6·10	1·55	9·2	43·11	3·96	58·7	9·8	7·6	,,	11·2	12·30	..	15·85	2·8	21·0	7·0
7/15	18·4	1·83	5·49	1·45	8·4	36·42	3·58	49·3	9·0	7·0	,,	10·4	11·30	..	14·7	2·6	18·0	7·0
7/16	14·6	1·625	4·88	1·35	7·6	30·29	3·21	40·6	8·2	6·3	,,	9·6	10·30	..	13·6	2·5	14·5	7·0
7/17	11·09	1·42	4·26	1·25	6·8	24·7	2·83	32·8	7·4	5·7	,,	8·8	9·30	..	12·45	2·5	12·0	7·0
7/18	8·18	1·22	3·66	1·20	6·1	20·63	2·45	27·3	6·7	5·1	,,	8·1	8·45	..	11·45	2·4	11·0	6·5
7/19	5·72	1·02	3·06	1·10	5·3	14·52	2·08	18·7	5·9	4·5	,,	7·3	7·40	..	10·30	2·3	8·75	3·5

TABLE NO. 195.—DETAILS OF BRAIDED RUBBER CABLES FOR 1000 TO 2000 VOLTS WORKING PRESSURE.—*continued.*
(Dimensions given in mm.; weights in kilog. per km.)

Conductor		Diameter		Rubber			Weight of Rubber		Prepared Tape		Braiding			Weight of Compound		Wages, shillings per km.		
Strand L.S.W.G.	Area, sq. mm.	Single Wire	Strand	Thickness	Diam. over	Area of Cross Section, sq. mm.	Para	Compound, sp. gr. = 1·5	Dia. over	Wght.	Material	Diam. over	Wght.	Stockholm Tar	Cable Compound	Winding and Stranding	Rubber Covering	Braiding
7/20	4·59	0·914	2·74	1·10	4·9	14·27	1·82	18·7	5·5	4·2	Cotton	6·9	6·90	..	9·75	2·2	8·50	3·5
7/20½	3·86	0·838	2·51	1·00	4·5	11·98	1·70	15·4	5·1	3·8	,,	6·5	6·40	..	9·20	2·0	8·50	3·5
7/21½	3·19	0·762	2·28	1·0	4·3	11·20	1·58	14·4	4·9	3·7	,,	6·3	6·15	..	8·9	2·15	8·25	3·5
7/22	2·78	0·711	2·13	1·0	4·1	10·44	1·45	13·5	4·7	3·5	,,	6·1	5·90	..	8·65	2·20	8·00	3·1
7/23	2·05	0·609	1·83	0·9	3·6	8·14	1·25	10·3	4·2	3·1	,,	5·2	3·95	..	5·75	2·25	7·60	3·1
7/25	1·42	0·508	1·54	0·9	3·4	7·66	1·07	9·9	4·0	3·0	,,	5·0	3·80	..	5·5	2·35	7·40	3·1
19/12	104·0	2·64	13·2	2·25	17·7	129·76	8·42	182·0	18·3	14·4	Jute	22·3	70·0	56	56	11·0	65·0	35·0
19/13	81·7	2·34	11·6	2·15	15·9	108·73	7·42	152·0	16·5	13·0	,,	20·5	66·0	53	53	8·0	60·0	34·0
19/14	61·5	2·03	10·1	2·05	14·2	90·27	6·47	125·7	14·8	11·6	,,	18·8	60·0	48	48	6·5	46·0	32·0
19/15	49·98	1·83	9·15	1·9	13·0	76·23	5·90	105·5	13·6	10·6	,,	17·6	54·0	44	44	5·6	32·0	30·0
19/16	39·65	1·626	8·12	1·8	11·7	63·72	5·22	87·8	12·3	9·6	,,	16·3	50·0	40	40	4·0	28·0	28·0
19/17	30·10	1·422	7·10	1·65	10·4	51·30	4·59	68·6	11·0	8·6	,,	15·0	46·0	37	37	3·9	25·0	25·0
19/18	22·2	1·22	6·10	1·55	9·2	41·64	3·95	56·5	9·8	7·6	Cotton	11·2	12·3	..	15·85	3·8	20·0	7·0
19/19	15·5	1·02	5·08	1·40	7·9	31·66	3·33	42·5	8·5	6·6	,,	9·9	10·7	..	14·00	3·7	15·0	7·0
19/20	12·47	0·914	4·57	1·35	7·3	27·73	3·02	37·1	7·9	6·1	,,	9·3	9·95		13·15	3·6	12·0	7·0
37/12	202·5	2·64	18·4	2·55	23·5	202·44	11·70	286·1	24·1	19·1	Jute	28·1	88·0	71	71	21·0	95·0	40·0
37/13	159·12	2·34	16·3	2·40	21·1	168·17	10·37	236·7	21·7	17·1	,,	25·7	80·0	64	64	17·0	80·0	38·0
37/14	119·75	2·03	14·2	2·35	18·9	142·85	9·05	200·7	19·5	15·4	,,	23·5	73·0	59	59	13·3	68·0	36·0
37/15	97·3	1·83	12·8	2·20	17·2	120·45	8·17	168·4	17·8	14·0	,,	21·8	68·0	55	55	13·0	56·0	35·0
37/16	77·2	1·626	11·3	2·10	15·5	101·69	7·22	141·7	16·1	12·7	,,	20·1	62·0	50	50	12·8	30·0	32·0

TABLE No. 196.—CONSTRUCTIONAL DATA AND WEIGHTS OF CONCENTRIC, RUBBER-COVERED CABLE FOR 2500 VOLTS WORKING PRESSURE.

(Dimensions given in mm. and Weights in kilog. per km.; Prices in shillings per km.).

Conductor, L.S.W.G.	Diam. of each Wire	Area of Conductor, sq. mm.	Diam. over Conductor	Radial Thickness of Rubber	Diam. over Rubber	Area of Rubber Cross Section, sq. mm.	Weight of Rubber		Weight of Prepared Tape	Wages		Outer Conductor		Diam. over Conductor	Radial Thickness of Rubber	Diam. over Rubber	Area of Rubber Cross Section, sq. mm.	Weight of Rubber		Weight of Prepared Tape	Wages	
							Para	Compound, sp. gr. = 1·5		Winding and Stranding	Rubber Covering	No of Wires	Diam. of Wires					Para	Compound, sp. gr. = 1·5		Winding and Stranding	Rubber Covering
7/20	0·914	4·59	2·74	1·6	5·9	22·76	1·83	31·4	5·0	2·30	11·0	71	0·28	7·1	1·6	10·3	47·69	4·6	64·6	8·5	25	22
7/19	1·02	5·72	3·06	1·7	6·5	27·15	2·08	37·6	5·5	2·3	14·0	64	·33	7·8	1·7	11·2	56·47	5·1	77·1	9·2	26	26
7/18	1·22	8·18	3·66	1·7	7·1	30·99	2·45	42·8	5·9	2·5	15·0	54	·43	8·6	1·7	12·0	61·97	5·6	84·6	9·6	27	28
7/17	1·42	11·09	4·26	1·8	7·9	37·40	2·83	51·9	6·6	2·6	18·0	48	·53	9·6	1·8	13·2	73·20	6·2	100·5	10·8	28	32
7/16	1·63	14·6	4·88	1·8	8·5	41·66	3·21	57·7	7·1	2·6	20·0	44	·64	10·4	1·8	11·0	79·18	6·7	108·7	11·5	29	42
7/15	1·83	18·4	5·49	1·9	9·3	48·92	3·59	68·0	7·7	2·7	23·0	41	·74	11·4	1·9	15·2	91·62	7·3	126·5	12·4	30	45
7/14	2·03	22·66	6·10	1·9	9·9	53·6	3·96	74·5	8·2	2·8	25·0	39	·84	12·2	1·9	16·0	98·16	7·8	135·5	13·1	32	47
19/20	0·914	12·47	4·57	1·8	8·2	38·69	3·02	53·5	6·8	3·5	18·5	49	·56	9·9	1·8	13·5	75·40	6·4	103·5	11·1	28	33
19/19	1·02	15·5	5·08	1·9	8·9	44·85	3·33	62·3	7·4	3·6	22·0	45	·64	10·8	1·9	14·6	86·80	6·9	119·9	11·9	29	45
19/18	1·22	22·2	6·1	1·9	9·9	52·13	3·96	72·3	8·2	3·8	25·0	40	·81	12·1	1·9	15·9	97·36	7·8	131·3	13·0	30	46
19/17	1·42	30·1	7·1	2·0	11·1	63·13	4·59	87·8	9·1	3·9	28·0	36	1·02	13·7	2·0	17·7	117·76	8·8	163·4	14·4	32	58
19/16	1·63	39·65	8·1	2·2	12·5	78·93	5·22	110·6	10·3	5·6	35·0	34	1·19	15·5	2·2	19·9	146·93	9·9	205·5	16·2	34	75
19/15	1·83	49·98	9·15	2·3	13·8	93·08	5·91	130·8	11·3	5·6	46·0	33	1·37	17·1	2·3	21·7	170·04	10·9	238·7	17·6	35	86
19/14	2·03	61·5	10·1	2·5	15·1	110·99	6·48	156·8	12·3	7·8	58·0	33	1·52	18·7	2·5	23·7	202·25	11·9	285·5	19·2	36	100
19/13	2·34	81·7	11·6	2·7	17·0	137·16	7·42	194·6	13·9	10·0	80·0	31	1·78	21·2	2·7	26·6	248·62	13·5	352·7	21·5	37	126
19/12	2·64	104·0	13·2	2·9	19·0	167·23	8·42	238·2	15·5	11·0	88·0	31	2·03	23·7	2·9	29·5	299·79	15·0	427·2	23·9	38	160
37/16	1·63	77·2	11·3	2·7	16·7	133·82	7·24	189·9	13·6	16·0	72·0	32	1·73	20·8	2·7	26·2	243·53	13·2	345·5	21·2	35	125
37/15	1·83	97·3	12·8	2·8	18·4	156·50	8·17	222·5	15·0	20·0	82·0	30	1·98	23·0	2·8	28·6	281·02	14·6	399·6	23·2	36	142

TABLE No. 197.—CONSTRUCTIONAL DATA FOR SINGLE CONDUCTOR, RUBBER INSULATED CABLE FOR 3000 VOLTS WORKING PRESSURE.

(Dimensions given in mm.; weights in kilog. per km.; prices in shillings per km.)

Conductor			Rubber			Weight of Rubber		Weight of Compound Rubber when no Pure used, sp. gr. =1·5	Weight of Prepared Tape	Wages	
Section, sq. mm.	Number and Diam. of Wires	Diam. over	Radial Thickness	Diam. over	Area of Cross Section	Para	Compound, sp. gr. =1·5			Winding and Stranding	Rubber Covering and Taping
10	7×1·35	4·1	2·5	9·1	54·47	2·7	77·7	81·7	7·3	2·5	14·5
16	7×1·71	5·1	2·55	10·2	65·38	3·3	93·1	98·1	8·2	2·6	18·5
25	7×2·13	6·4	2·6	11·6	79·95	4·1	113·8	119·9	9·3	2·8	25·0
35	19×1·53	7·7	2·7	13·1	95·21	5·0	135·3	142·8	10·5	3·9	30·0
50	19×1·83	9·2	2·8	14·8	115·53	5·9	164·4	173·3	11·8	5·6	45·0
70	19×2·17	10·8	2·9	16·7	139·73	7·0	199·1	209·6	13·3	7·8	57·5
95	19×2·53	12·7	3·05	18·8	169·92	8·1	242·7	254·9	15·0	10·5	72·0
120	37×2·03	14·2	3·15	20·5	192·28	9·1	274·8	288·4	16·4	13·3	86·0
150	37×2·27	15·9	3·25	22·4	221·34	10·1	316·9	332·0	17·9	16·7	98·0

Table No. 198.—Constructional Data of

With 0·8 mm. diameter Conductors insulated with

No. of Pairs	Dia. of Pair	Diam. of Laid up Pairs	Diam. over Paper Tape	Diam. over Cotton Tape	Lead Sheath		Weight of Cable, kilog. per km.	Lead Sheath		Dia. over Jute Serving	Segmental Sheath	
					Thickness	Dia. over		Thickness	Dia. over		No. of Strips	Dimensions
1	3·45	3·45	3·95	4·5	1·3	7·1	290	..	..	..	..	..
2	3·45	6·9	7·4	7·9	1·3	10·5	460	..	..	..	..	..
4	3·45	9·0	9·5	10·0	1·4	12·8	630	1·3	12·6	13·6	6	4×3·4×1·4
5	3·45	9·3	9·8	10·3	1·4	13·1	660	1·4	13·1	14·1	6	4×3·4×1·4
7	3·45	9·8	10·3	10·8	1·5	13·8	750	1·4	13·6	14·6	7	4×3·4×1·4
10	3·45	12·4	12·9	13·4	1·7	16·8	1050	1·6	16·6	17·6	7	4·9×4·3×1·7
14	3·45	16·6	17·1	17·6	1·7	21·0	1360	1·6	20·8	21·8	7	4·9×4·3×1·7
20	3·45	17·3	17·8	18·3	2·0	22·3	1710	1·8	21·9	22·9	8	4·9×4·3×1·7
28	3·45	21·0	21·5	22·0	2·0	26·0	2080	1·8	25·6	26·6	9	4·9×4·3×1·7
50	3·45	29·0	29·5	30·0	2·2	34·4	3170	2·0	34·0	35·0	11	4·9×4·3×1·7
56	3 45	29·6	30·1	30·6	2·2	35·0	3290	2·0	34·6	35·6	11	4·9×4·3×1·7
100	3·45	40·0	40·5	41·0	2·5	46·0	5140	2·2	45·4	46·4	15	4·9×4·3×1·7
112	3·45	42·6	43·1	43·6	2·5	48·6	5530	2·2	48·0	49·0	12	6·2×5·0×1·7
150	3·45	49·7	50·2	50·7	2·8	56·3	7230	2·5	55·7	56·7	15	6·2×5·0×1·7
168	3·45	52·2	52·7	53·2	2·8	58·8	7700	2·5	58·2	59·2	15	6·2×5·0×1·7
200	3·45	56·6	57·1	57·6	3·0	63·6	8990	3·0	63·6	64·6	16	6·2×5·0×1·7
224	3·45	59·6	60·1	60·6	3·0	66·6	9610	3·0	66·6	67·6	16	6·2×5·0×1·7
250	3·45	63·5	64·0	64·5	3·0	70·5	10350	3·0	70·5	71·5	18	6·2×5·0×1·7

PAPER AND AIR SPACE TELEPHONE CABLES.

two layers of Paper. (Dimensions in mm.)

Strips Dia. over	Weight of Open Armoured Cable, kilog. per km.	Lead Sheath Thickness	Lead Sheath Dia. over	Dia. over Jute Serving	Segmental Sheath Strips No. of Strips	Segmental Sheath Strips Dimensions	Segmental Sheath Strips Dia. over	Weight of Closed Armoured Cable, kilog. per km.	Dia. over Outside Jute Serving	Weight of Armoured and Served Cable, kilog. per km.	No. of Pairs
..	..	1·2	6·9	7·9	7	4×3·4×1·4	10·7	620	13·9	680	1
..	..	1·2	10·3	11·3	10	4×3·4×1·4	14·1	930	17·3	1020	2
16·4	930	1·3	12·6	13·6	12	4×3·4×1·4	16·4	1180	19·6	1280	4
16·9	1015	1·3	12·9	13·9	12	4×3·4×1·4	16·7	1220	19·9	1320	5
17·4	1100	1·4	13·6	14·6	13	4×3·4×1·4	17·4	1350	20·6	1450	7
21·0	1560	1·5	16·4	17·4	12	4·9×4·3×1·7	20·8	1810	24·0	1940	10
25·2	1870	1·5	20·6	21·6	14	4·9×4·3×1·7	25·0	2230	28·2	2380	14
26·3	2220	1·7	21·7	22·7	15	4·9×4·3×1·7	26·1	2580	29·3	2730	20
30·0	2630	1·7	25·4	26·4	17	4·9×4·3×1·7	29·8	3040	33·0	3210	28
38·4	3930	1·8	33·6	34·6	22	4·9×4·3×1·7	38·0	4360	41·2	4590	50
39·0	3970	1·8	34·2	35·2	22	4·9×4·3×1·7	38·6	4400	41·8	4630	56
49·8	5920	2·0	45·0	46·0	30	4·9×4·3×1·7	49·4	6530	52·6	6830	100
52·4	6240	2·0	47·6	48·6	24	6·2×5·0×1·7	52·0	6810	55·2	6910	112
60·1	8170	2·2	55·1	56·1	29	6·2×5·0×1·7	59·5	8640	62·7	9010	150
62·6	8610	2·2	57·6	58·6	29	6·2×5·0×1·7	62·0	9040	65·2	9430	168
68·0	10740	2·5	62·6	63·6	33	6·2×5·0×1·7	67·0	10820	70·2	11240	200
71·0	11270	2·5	65·6	66·6	33	6·2×5·0×1·7	70·0	11300	73·2	11750	224
74·9	12230	2·5	69·5	70·5	36	6·2×5·0×1·7	73·9	12330	77·1	12800	250

TABLE NO. 199.—DETAILS OF BRAIDED RUBBER CABLES FOR 3000 VOLTS WORKING PRESSURE.

(Dimensions given in mm.; weights in kilog. per km.)

Conductor		Diam.		Rubber			Weight of Rubber		Prepared Tape		Braiding			Weight of Compound		Wages, Shillings per km.		
Strand, L.S.W.G.	Area, sq. mm.	Single Wire	Strand	Thick-ness	Diam. over	Area of Cross Section	Para	Com-pound, sp. gr. =1·5	Diam. over	Weight	Material	Diam. over	Weight	Stock-holm Tar	Cable Com-pound	Wind-ing and Strand-ing	Rubber Cover-ing	Braid-ing
19/12	104·0	2·64	13·2	3·1	19·4	179·29	12·4	250·3	20·0	15·8	3 ply 1 kilog Jute	24·0	74	59	59	10·5	75·0	36
19/13	81·7	2·34	11·6	3·0	17·6	153·46	11·2	213·4	18·2	14·4		22·2	70	56	56	9·0	60·0	35
19/14.	61·5	2·03	10·1	2·85	15·8	127·98	10·1	176·8	16·4	12·9	,,	20·4	61	51	51	7·8	50·0	32
19/15	49·98	1·83	9·15	2·80	14·8	115·54	9·5	159·1	15·4	12·1	,,	19·4	60	48	48	5·6	45·0	32
19/16	39·65	1·63	8·12	2·75	13·6	101·47	8·7	139·2	14·2	11·2	,,	18·2	56	45	45	4·0	32·0	30
19/17	30·1	1·42	7·10	2·7	12·5	89·07	8·0	121·6	13·1	10·3	,,	17·1	52	42	42	3·8	28·0	30
19/18	22·2	1·22	6·10	2·6	11·3	75·45	7·3	102·2	11·9	9·3	,,	15·9	48	38	38	3·5	20·0	28
19/19	15·5	1·02	5·10	2·55	10·2	64·35	6·6	86·6	10·8	8·4	,,	14·8	44	35	35	3·2	18·0	26
19/20	12·47	0·914	4·57	2·5	9·6	58·26	6·2	78·1	10·2	8·1	,,	14·2	42	34	34	3·0	15·0	25
37/12	202·5	2·64	18·4	3·5	25·4	275·41	16·1	389·0	26·0	20·6	,,	30·0	94	75	75	17·0	120·0	42
37/13	159·12	2·34	16·3	3·3	22·9	230·37	14·5	323·8	23·5	18·6	,,	27·5	86	69	69	16·7	105·0	40
37/14	119·75	2·03	14·2	3·15	20·5	192·26	13·0	268·9	21·6	16·7	,,	25·6	80	64	64	13·3	85·0	38
37/15	97·3	1·83	12·8	3·05	18·9	168·65	12·0	235·0	19·5	15·4	,,	23·5	74	59	59	13·0	72·0	36
37/16	77·2	1·63	11·3	3·00	17·3	147·84	11·0	205·3	17·9	14·1	,,	21·9	68	54	54	12·8	58·0	35

CHAPTER XIII.

MISCELLANEOUS.

Self-Induction of Cables.

THE self-induction of a cable circuit can be calculated by assuming either that the current flows equally distributed throughout the cross-section of the conductors, or that the current flows concentrated within a very thin annulus at the surface of the conductors. Owing to the eddy currents induced in conductors carrying alternating current, the distribution of the current is unequal, the current density being a minimum at the axis and a maximum at the surface of the conductor. The exact distribution of the current is difficult to calculate, but depends upon the diameter of the conductor and the periodicity of the current.

The arithmetical mean of the two formulæ obtained when the above assumptions are made, is generally considered to give results quite accurate enough for commercial calculations.

The following are the formulæ for calculating the self-induction of various types of cable; in each case the formula A, is obtained by assuming equal distribution of current in the conductor, the formula B, is obtained by assuming the concentration of the current in a very thin annulus at the surface of the conductor, and C is the formula generally used and assumed to allow for the skin effect.

Multicore Cables:

A. $$L_s = \left(0 \cdot 2 + 0 \cdot 92 \log_{10} \frac{2a}{d}\right) 10^{-3} \text{ Henry per kilometre loop.}$$

B. $$L_s = \left(0 \cdot 92 \log_{10} \frac{2a}{d}\right) 10^{-3} \text{ Henry per kilometre loop.}$$

C. $$L_s = \left(0 \cdot 1 + 0 \cdot 92 \log_{10} \frac{2a}{d}\right) 10^{-3} \text{ Henry per kilometre loop,}$$

C. or $$L_s = \left(0 \cdot 05 + 0 \cdot 46 \log_{10} \frac{2a}{d}\right) 10^{-3} \text{ Henry per core per kilometre,}$$

where d is the diameter of each conductor and a is the distance between the centres of gravity of the two conductors. The expression self-induction "per core" has, strictly speaking, no meaning; it is, however, a convenient form for three-phase calculations.

Concentric Cables:

A. $$L_s = 0 \cdot 46 \left\{ \log_{10} \left(\frac{d_2}{d_1}\right) + \frac{d_3^2}{d_3^2 - d_2^2} \log_{10} \left(\frac{d_3}{d_2}\right) \right\} 10^{-3}$$

Henry per kilometre.

B. $$L_s = \left\{0 \cdot 46 \log_{10} \left(\frac{d_2}{d_1}\right) \right\} 10^{-3} \text{ Henry per kilometre.}$$

C. $$L_s = 0 \cdot 46 \left\{ \log_{10} \frac{d_2}{d_1} + \frac{d_3^2}{2\,(d_3^2 - d_2^2)} \log_{10} \left(\frac{d_3}{d_2}\right) \right\} 10^{-3}$$

Henry per kilometre.

where d_1 is the diameter of the inner conductor.
d_2 is the diameter over the inner insulation,
d_3 is the diameter over the outer conductor.

Triple Concentric Cables.—Self-Induction between the middle and outer conductors.

A. $$L_s = 0{\cdot}46\left\{\log_{10}\frac{d_2}{d_1} + \frac{d_3^2}{d_3^2 - d_2^2}\log_{10}\left(\frac{d_3}{d_2}\right) - \frac{d_0^2}{d_1^2 - d_0^2}\log_{10}\left(\frac{d_1}{d_0}\right)\right\}10^{-3}$$ Henry per kilometre.

B. $$L_s = 0{\cdot}46\ \left\{\log_{10}\left(\frac{d^2}{d_1}\right)\right\}10^{-3}$$ Henry per kilometre.

C. $$L_s = 0{\cdot}46\ \left\{\log_{10}\left(\frac{d^2}{d_1}\right) + \frac{1}{2}\left[\frac{d_3^2}{d_3^2 - d_2^2}\log_{10}\left(\frac{d_3}{d_2}\right) - \frac{d_0^2}{d_1^2 - d_0^2}\log_{10}\left(\frac{d_1}{d_0}\right)\right]\right\}10^{-3}$$ Henry per kilometre.

Where d_0 is the diameter over the inner insulation.
d_1 is the diameter over the middle conductor.
d_2 is the diameter over the middle insulation.
d_3 is the diameter over the outer conductor.

In the case of multicore cables the self-induction formula can be written—

$$L_s = \left\{x + 0{\cdot}92\log_{10}\left(\frac{2a}{d}\right)\right\}10^{-3}$$ Henry per kilometre loop

where x is a constant whose value depends upon the current distribution in the conductor; with equal distribution its value is 0·2, and with complete concentration near the surface its value is zero. Tests on actual cables allow of the value of the constant x being determined experimentally.* Table No. 200 gives the results of tests on various three-core (round conductor) cables.

TABLE No. 200.—SELF-INDUCTION TESTS ON THREE-CORE CABLES. VALUE OF CONSTANT x.

Area of each Conductor		Thickness of insulation in mm. between Conductors and between Conductors and Lead									
sq. mm.	sq. inch	1·4	1·5	2·3	3·0	4·0	5·5	6·0	7·0	8·0	10·0
10	0·0155	..	..	0·151	..	..	..	0·140	0·129	..	..
16	·0248	..	..	0·138	..	0·134	..	..	..	..	..
25	·0387	..	..	0·121	0·117	0·085	0·103	..	..	..	..
35	·0542	..	0·127	0·134	..	..	0·086	..	0·058	..	..
50	·0775	..	..	0·090	..	0·029	..	..	..	..	0·016
70	·1085	..	..	0·097	0·078	..	..	..	..	0·105	..
95	·147	0·079	0·047	0·056	..	..	..	..	..	..	..
120	·186	..	..	..	..	0·050	..	..	..	..	..
185	·286	..	..	−0·039	..	..	..	..	..	..	..
240	·372	..	..	−0·045	..	..	..	..	..	..	..
310	·480	..	..	..	−0·023	..	..	..	..	..	..

* See "Self-Induction of Three-Phase Cables," by F. J. O. Howe. "Electrician," vol. lxii., p. 686, 1909.

Electrostatic Capacity.

The electrostatic capacity of any cable depends upon the dielectric constant of the insulating material and a dimension term or form factor. The dielectric constant should be determined from actual cables and not from samples of the material. Table No. 201 gives the average values of the dielectric constant for various cable dielectrics.

Table No. 201.—Dielectric Constants.

Cable Dielectric	Value of K
Impregnated paper	2·8 to 3·8
Impregnated jute	3·0 „ 4·0
Gutta-percha	3·6
Paper and air space as in telephone cables	1·7 to 1·9
Pure, separator and jacket rubber combined	3·0 „ 5·5

The dielectric constant determined from the capacity of the cable as measured by the ballistic method is liable, in the case of paper insulated cables, to be inaccurate owing to the effects of absorption and leakage; the capacity can be accurately determined by means of a secohmmeter.*

The dielectric constant of rubber insulation varies with the percentage of rubber used in the compound rubbers, and also with the mineral ingredients.

Single and Concentric Conductor Cables.—In cases where the conductor is surrounded by a concentric conductor, lead sheath, or armour, the form factor can be easily determined, and therefore the capacity of any such cable calculated.

The electrostatic capacity of a condenser formed of two concentric conductors is equal to—

$$\frac{K\,l}{2\log_\epsilon \frac{D}{d}} \text{ electrostatic units,}$$

where K = dielectric constant of insulating material.
l = length of cable in centimetres.
d = diameter over the inner conductor.
D = diameter over the dielectric.

Therefore, the capacity in microfarads per kilometre is equal to—

$$\frac{K\,.\,10^5}{2\log_\epsilon\left(\frac{D}{d}\right)9\,.\,10^5} = \frac{K}{18\log_\epsilon \frac{D}{d}} = \frac{0{\cdot}02415\,K}{\log_{10}\frac{D}{d}}$$

or the capacity in microfarads per statute mile is equal to—

$$\frac{0{\cdot}0388\,K}{\log_{10}\frac{D}{d}}.$$

Table No. 202 gives the value of $\log_{10}\frac{D}{d}$ for various conductors and various thicknesses of dielectric.

* See "Capacity of Cables," by F. J. O. Howe. "The Electrician," vol. lx. p. 864.

TABLE No. 202.—

Cross Section of Conductor, mm².	Diam. of Conductor, mm.	Radial Thickness of									
		1·00	1·25	1·50	1·75	2·00	2·25	2·50	2·75	3·00	3·5
4	2·26	0·2758	0·3222	0·3664	0·3988	0·4425	0·4751	0·5070	0·5359	0·5634	0·613
6	2·76	·2368	·2806	·3197	·3551	·3897	·4200	·4487	·4764	·5017	·549
10	4·05	·1740	·2100	·2400	·2710	·2990	·3240	·3490	·3730	·4140	·435
16	5·13	·1440	·1730	·2010	·2270	·2500	·2740	·2960	·3170	·3360	·374
25	6·9	·1106	·1335	·1570	·1790	·1990	·2180	·2380	·2550	·2720	·304
35	7·9	·0980	·1200	·1400	·1600	·1780	·1960	·2130	·2300	·2460	·275
50	9·4	·0839	·1040	·1210	·1370	·1540	·1700	·1850	·2000	·2150	·242
70	11·2	·0719	·0878	·1030	·1170	·1330	·1460	·1600	·1740	·1860	·211
95	12·95	·0626	·0766	·0906	·1040	·1170	·1290	·1410	·1540	·1660	·188
120	14·5	·0561	·0689	·0817	·0941	·1060	·1170	·1280	·1390	·1500	·171
150	16·3	·0504	·0615	·0734	·0842	·0955	·1060	·1170	·1270	·1370	·155
185	18·5	·0453	·0550	·0656	·0756	·0846	·0945	·1040	·1130	·1220	·139
210	19·5	·0430	·0523	·0622	·0719	·0813	·0874	·0986	·108	·1170	·133
240	20·6	·0402	·0500	·0592	·0682	·0774	·0864	·0945	·104	·1120	·126
280	22·1	·0378	·0467	·0554	·0641	·0726	·0821	·0885	·0969	·1040	·119
310	23·2	·0358	·0445	·0531	·0615	·0689	·0774	·0846	·0927	·1000	·114
355	24·9	·0334	·0414	·0492	·0569	·0648	·0722	·0795	·0867	·0938	·107
400	26·3	·0322	·0390	·0469	·0542	·0615	·0689	·0756	·0828	·0892	·102
500	29·5	·0286	·0354	·0430	·0484	·0554	·0618	·0682	·0745	·0803	·092
625	33·0	·0257	·0318	·0378	·0434	·0500	·0553	·0616	·0671	·0726	·083
725	35·3	·0241	·0302	·0358	·0414	·0469	·0523	·0580	·0637	·0692	·078
800	37·5	·0224	·0278	·0334	·0386	·0438	·0492	·0539	·0592	·0645	·074
1000	41·4	·0204	·0220	·0306	·0358	·0406	·0450	·0500	·0542	·0588	·067

VALUE OF LOG $\frac{D}{d}$.

Dielectric in mm.

4·0	4·5	5·0	6·0	7·0	8·0	9·0	10·0	11·0	12·0	13·0	14·0	15·0
0·658	0·697	0·734	0·800	0·857	0·908	0·953	0·994	1·013	1·065	1·097	1·127	1·154
·591	·629	·664	·728	·783	·832	·876	·916	0·952	0·987	1·018	1·046	1·074
·474	·508	·540	·598	·649	·695	·736	·774	·809	·841	0·871	0·899	0·925
·408	·440	·470	·524	·572	·614	·654	·690	·723	·754	·783	·810	·835
·334	·362	·389	·438	·481	·521	·557	·591	·622	·651	·678	·704	·728
·304	·330	·355	·401	·443	·481	·516	·548	·578	·607	·633	·658	·681
·267	·292	·314	·358	·396	·431	·465	·495	·524	·551	·576	·600	·623
·234	·256	·277	·316	·352	·385	·416	·445	·472	·497	·521	·544	·566
·209	·229	·248	·284	·318	·349	·378	·405	·431	·455	·478	·500	·520
·191	·210	·228	·262	·293	·323	·350	·376	·401	·424	·446	·467	·487
·173	·191	·207	·239	·269	·297	·323	·347	·371	·393	·414	·434	·453
·156	·172	·188	·217	·244	·270	·295	·318	·340	·361	·381	·400	·418
·149	·164	·179	·208	·235	·260	·284	·306	·327	·348	·368	·386	·404
·142	·157	·171	·199	·225	·249	·272	·294	·316	·335	·354	·373	·390
·134	·148	·162	·188	·213	·236	·258	·280	·300	·319	·338	·356	·373
·128	·142	·155	·180	·204	·227	·249	·270	·290	·308	·326	·344	·360
·121	·134	·146	·170	·193	·215	·236	·256	·275	·292	·310	·327	·343
·115	·128	·140	·163	·185	·206	·226	·245	·264	·282	·299	·315	·331
·104	·115	·126	·148	·168	·188	·207	·225	·242	·258	·274	·290	·304
·094	·104	·114	·134	·153	·171	·188	·205	·222	·237	·252	·267	·281
·088	·098	·108	·127	·145	·163	·179	·195	·210	·226	·240	·253	·267
·084	·093	·102	·120	·137	·154	·170	·185	·200	·214	·228	·242	·255
·076	·058	·094	·110	·126	·142	·157	·171	·185	·199	·212	·224	·236

Multicore Cables.—The capacity of multicore cables can be calculated, but the formulæ are very cumbersome, and give accurate results only in the case of a perfectly homogeneous dielectric.*

The more satisfactory method is to measure the capacity of various cables and plot curves showing the capacity in relation to the thickness of the dielectric, and the size of the conductor.

At least two values of the capacity are necessary to completely determine the capacity constants of any multicore cable.

In the case of *two-core* cable, the following tests would be taken :—

(i) Capacity of conductor 1 against conductor 2 and lead sheath $= c_1$.

(ii) Capacity of conductors 1 and 2 against the lead sheath $= c_2$.

The working or apparent capacity per core will be equal to—

$$c = 2c_1 - \frac{c_2}{2}$$

In the case of *three-core* cable :—

(i) Capacity of conductor 1 against conductors 2 and 3 and lead sheath $= c_1$.

(ii) Capacity of conductors $1 + 2 + 3$, against the lead sheath $= c_2$, or

(iii) Capacity of conductors $1 + 2$ against conductor 3 and lead sheath $= c_3$.

Then the working or apparent capacity per core will be equal to—

$$c = \frac{3\,c_1}{2} - \frac{c_2}{6} \quad \text{or} \quad = 2\,c_1 - \frac{c_3}{2}$$

In the case of *four-core* cable :—

(i) Capacity of conductor 1 against conductors $2 + 3 + 4$ and lead sheath $= c_1$.

(ii) Capacity of conductors $1 + 3$ against conductors $2 + 4$ and lead sheath $= c_2$ (note conductors number 1 and 3 are diagonally situated).

Then the working or apparent capacity per core will be equal to—

$$c = 2\,c_1 - \frac{c_2}{2}.$$

The following curves give the value of the various capacities for three-core cables; in each case c_1 is the capacity of one conductor against the other two conductors and earth, c_2 is the capacity of all three conductors against earth, and

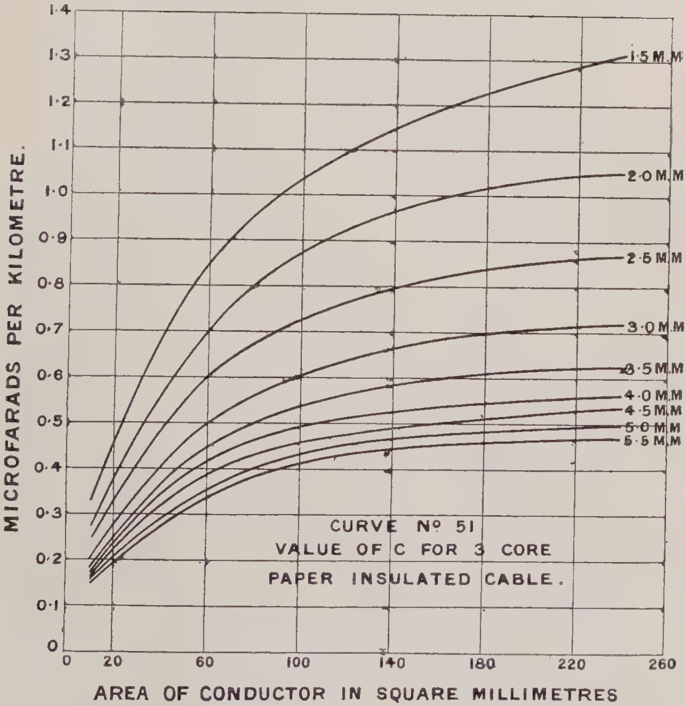
$$c = \frac{3\,c_1}{2} - \frac{c_2}{6}$$

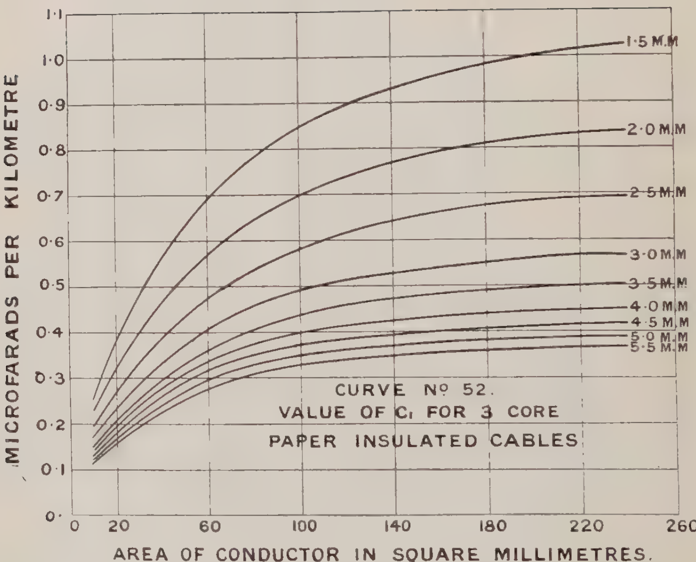
is the working or apparent capacity per conductor. The figure at the side of the curve gives the thickness of the dielectric between conductors, and between conductors and lead sheath. The capacity values, of course, depend to a certain extent upon the composition of the impregnating compound.

The capacity can also be determined by measuring the charging current when a sine wave voltage is applied to the cable. If A be the effective value of the charging current in amperes, V the effective value of the voltage, which in the case of three-phase working is equal to the voltage between phases divided by $\sqrt{3}$, and $\backsim$ be the frequency, then—

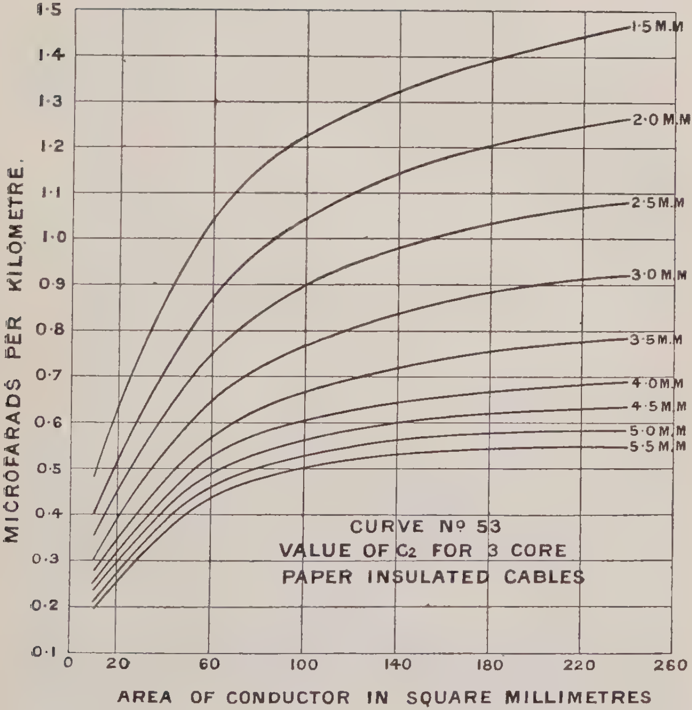
$$\frac{A \,.\, 10^6}{2\,\pi \backsim V} = \text{Capacity in microfarads.}$$

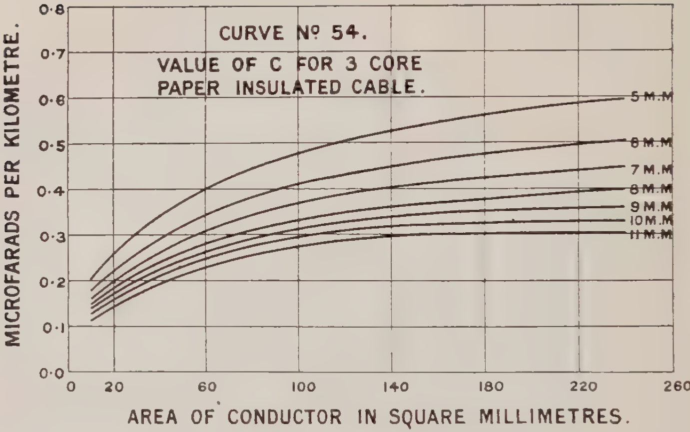
* See "Beiträge zur Theorie der Kabel," by Leon Lichtenstein.

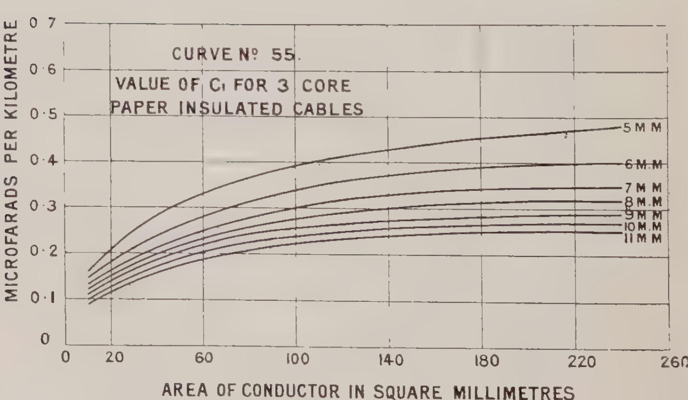

MICROFARADS PER KILOMETRE.
1·4
1·3
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
1·5 M.M
2·0 M.M
2·5 M.M
3·0 M.M
3·5 M.M
4·0 M.M
4·5 M.M
5·0 M.M
5·5 M.M
CURVE Nº 51
VALUE OF C FOR 3 CORE
PAPER INSULATED CABLE.

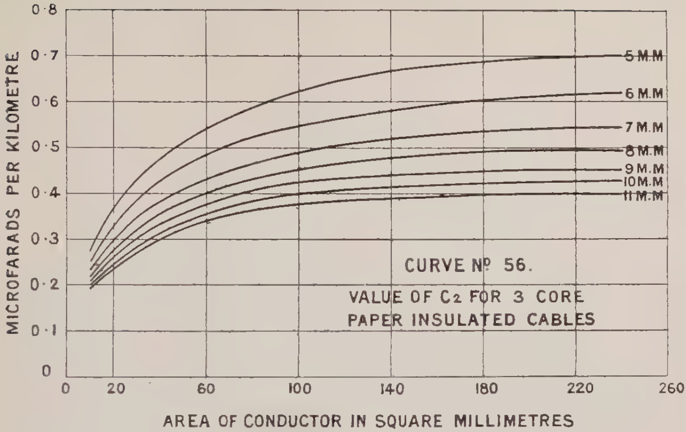


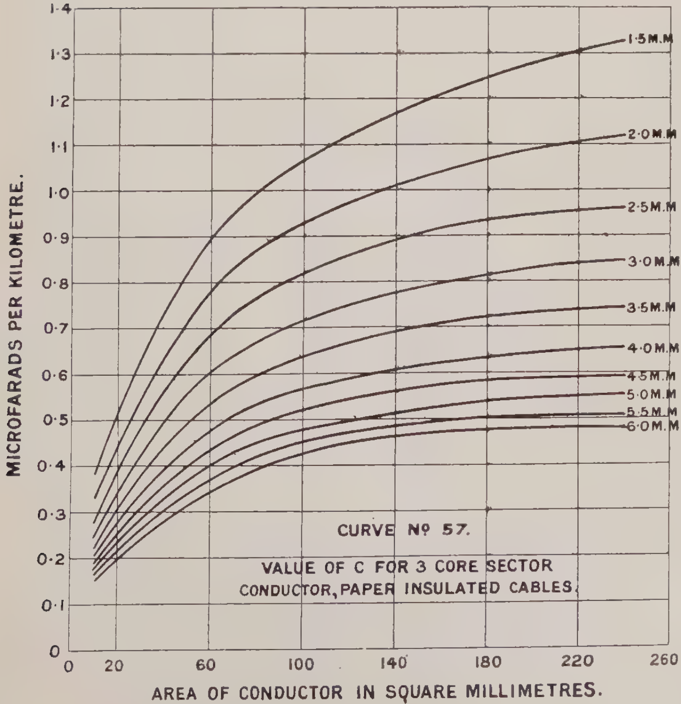
CURVE No. 52.
VALUE OF C_1 FOR 3 CORE
PAPER INSULATED CABLES

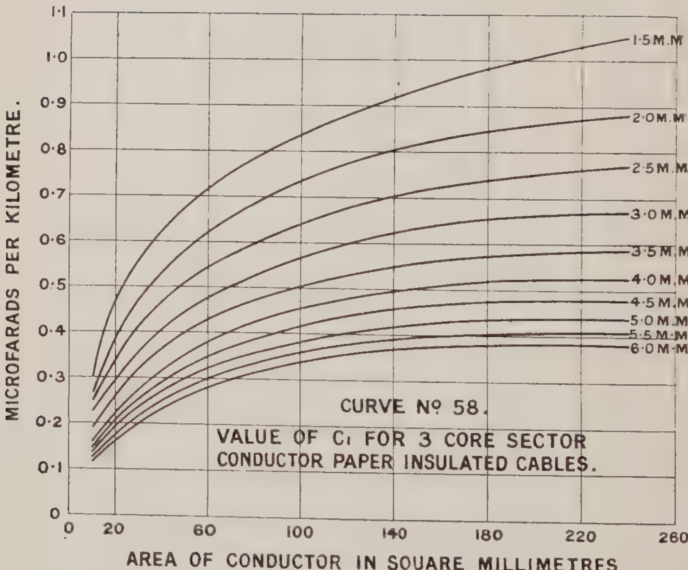

MICROFARADS PER KILOMETRE.
1·5
1·4
1·3
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
20
60
100
140
180
220
260
1·5 M.M
2·0 M.M
2·5 M.M
3·0 M.M
3·5 M.M
4·0 M.M
4·5 M.M
5·0 M.M
5·5 M.M
CURVE Nº 53
VALUE OF C2 FOR 3 CORE
PAPER INSULATED CABLES
AREA OF CONDUCTOR IN SQUARE MILLIMETRES

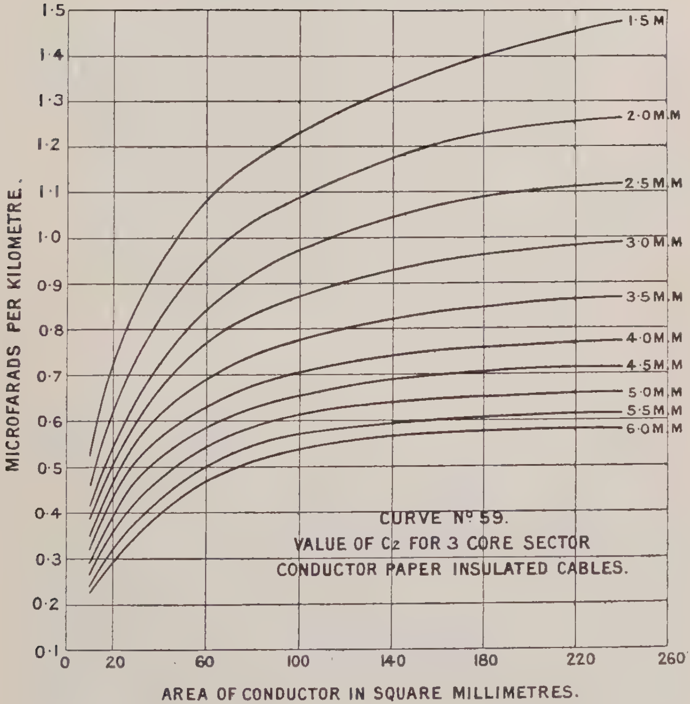

CURVE Nº 54.
VALUE OF C FOR 3 CORE
PAPER INSULATED CABLE.
MICROFARADS PER KILOMETRE.
0·0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8
5 M.M
6 M.M
7 M.M
8 M.M
9 M.M
10 M.M
11 M.M
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.

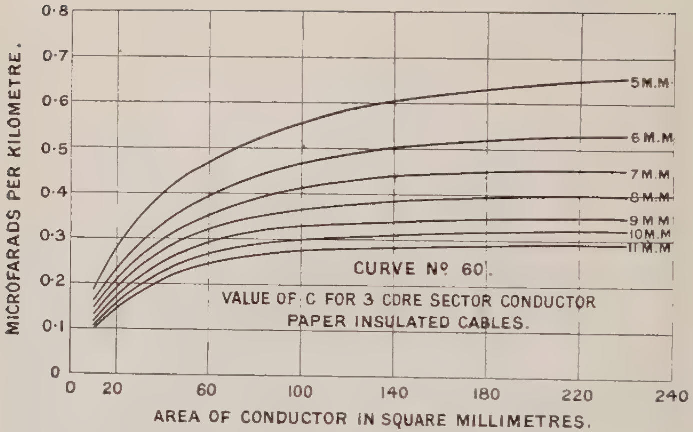

CURVE Nº 55.
VALUE OF C_1 FOR 3 CORE
PAPER INSULATED CABLES
MICROFARADS PER KILOMETRE
0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
5 M M
6 M.M
7 M M
8 M.M
9 M M
10 M.M
11 M M
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES

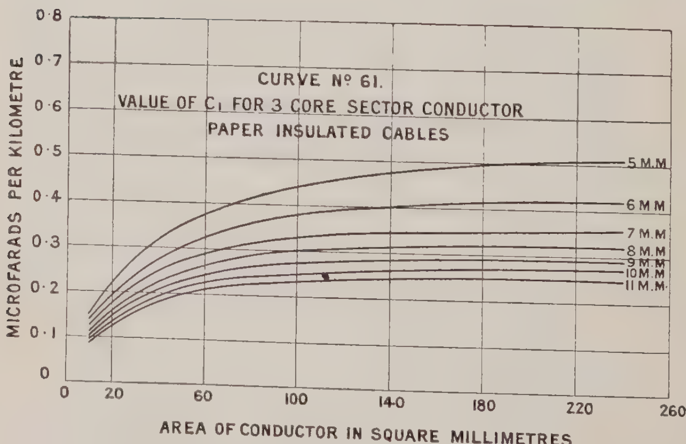

0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
MICROFARADS PER KILOMETRE
5 M.M
6 M.M
7 M.M
8 M.M
9 M.M
10 M.M
11 M.M
CURVE Nº 56.
VALUE OF C2 FOR 3 CORE PAPER INSULATED CABLES
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES

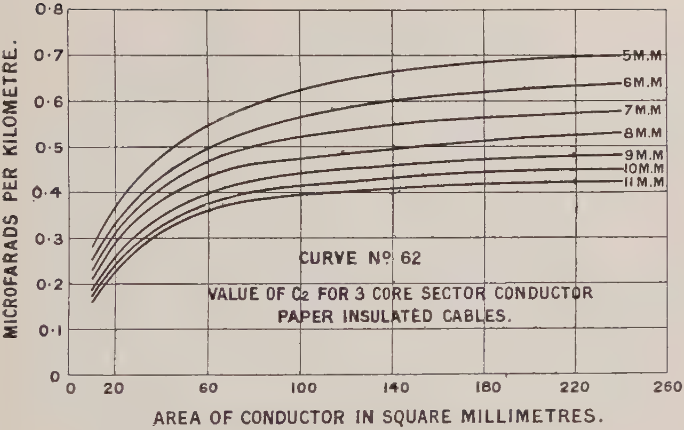

1·4
1·3
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
MICROFARADS PER KILOMETRE.
1·5 M.M
2·0 M.M
2·5 M.M
3·0 M.M
3·5 M.M
4·0 M.M
4·5 M.M
5·0 M.M
5·5 M.M
6·0 M.M
CURVE Nº 57.
VALUE OF C FOR 3 CORE SECTOR CONDUCTOR, PAPER INSULATED CABLES.
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.

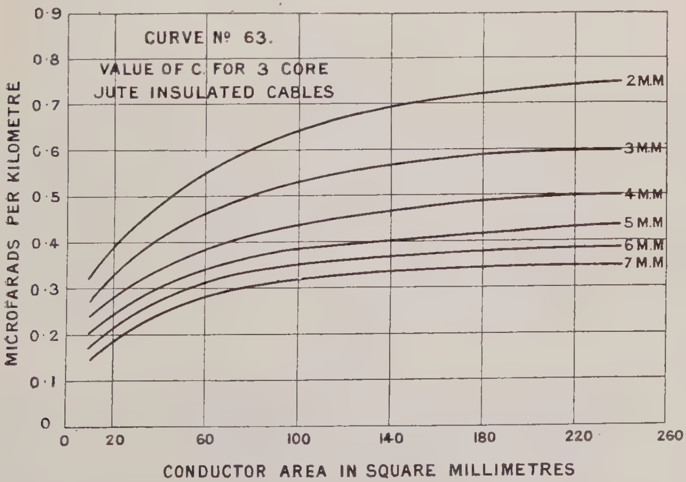

1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
MICROFARADS PER KILOMETRE.
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
1·5 M.M
2·0 M.M
2·5 M.M
3·0 M.M
3·5 M.M
4·0 M.M
4·5 M.M
5·0 M.M
5·5 M.M
6·0 M.M
CURVE Nº 58.
VALUE OF C_1 FOR 3 CORE SECTOR CONDUCTOR PAPER INSULATED CABLES.

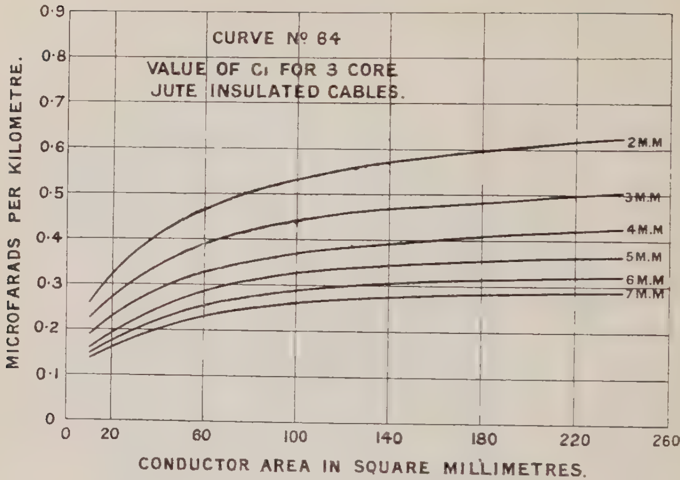

1·5
1·4
1·3
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
MICROFARADS PER KILOMETRE.
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
1·5 M
2·0 M.M
2·5 M.M
3·0 M.M
3·5 M.M
4·0 M.M
4·5 M.M
5·0 M.M
5·5 M.M
6·0 M.M
CURVE No. 59.
VALUE OF C2 FOR 3 CORE SECTOR
CONDUCTOR PAPER INSULATED CABLES.

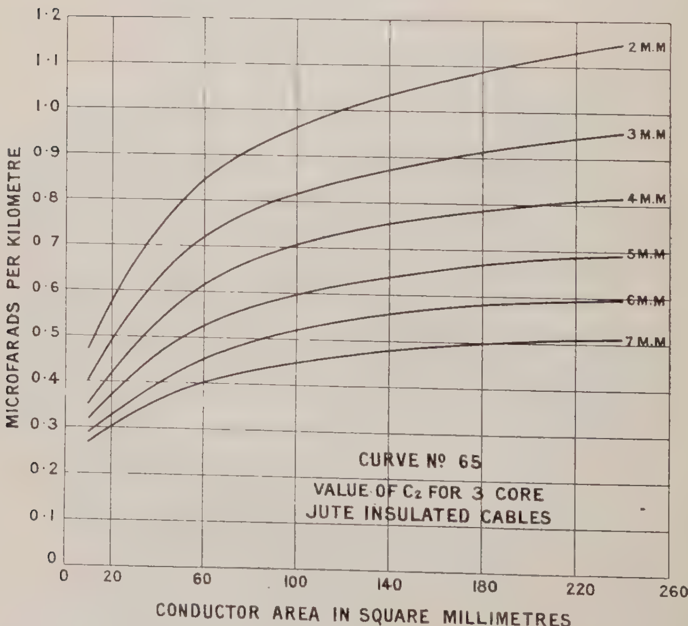

CURVE Nº 60.
VALUE OF C FOR 3 CORE SECTOR CONDUCTOR
PAPER INSULATED CABLES.
MICROFARADS PER KILOMETRE.
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.
5 M.M
6 M.M
7 M.M
8 M.M
9 M.M
10 M.M
11 M.M
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
0
20
60
100
140
180
220
240


CURVE Nº 61.
VALUE OF C_1 FOR 3 CORE SECTOR CONDUCTOR
PAPER INSULATED CABLES
MICROFARADS PER KILOMETRE
AREA OF CONDUCTOR IN SQUARE MILLIMETRES
5 M.M
6 M M
7 M.M
8 M.M
9 M.M
10 M.M
11 M.M
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
0
20
60
100
140
180
220
260


0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
MICROFARADS PER KILOMETRE.
5M.M
6M.M
7M.M
8M.M
9M.M
10M.M
11M.M
CURVE Nº 62
VALUE OF C2 FOR 3 CORE SECTOR CONDUCTOR
PAPER INSULATED CABLES.
0
20
60
100
140
180
220
260
AREA OF CONDUCTOR IN SQUARE MILLIMETRES.


0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
MICROFARADS PER KILOMETRE
CURVE Nº 63.
VALUE OF C. FOR 3 CORE
JUTE INSULATED CABLES
2M.M
3M.M
4M.M
5M.M
6M.M
7M.M
0
20
60
100
140
180
220
260
CONDUCTOR AREA IN SQUARE MILLIMETRES


CURVE Nº 64
VALUE OF C₁ FOR 3 CORE JUTE INSULATED CABLES.
MICROFARADS PER KILOMETRE.
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
2 M.M
3 M.M
4 M.M
5 M.M
6 M.M
7 M.M
0
20
60
100
140
180
220
260
CONDUCTOR AREA IN SQUARE MILLIMETRES.


MICROFARADS PER KILOMETRE
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
2 M.M
3 M.M
4 M.M
5 M.M
6 M.M
7 M.M
CURVE Nº 65
VALUE OF C₂ FOR 3 CORE JUTE INSULATED CABLES
0
20
60
100
140
180
220
260
CONDUCTOR AREA IN SQUARE MILLIMETRES

Dielectric Resistance.

The dielectric resistance of single conductor and concentric conductor cables can be calculated from the formula—

$$\frac{\sigma \cdot \log_{10} \frac{D}{d}}{439000} = \text{megohms per statute mile at } 60^\circ \text{ F.}$$

where σ is the specific dielectric resistance of the insulating material, i.e. the resistance per cubic centimetre after one minute's electrification at 60° F.

In the case of multicore cables the dielectric resistance is best obtained from curves based upon tests on actual cables.

Carrying Capacity of Cables.

The current allowable in any conductor can be determined with regard to either economy or the safe working temperature of the cable. In the case of cable working at fairly low voltages the current that would ultimately raise the cable to the safe working temperature is generally much greater than the economical current, therefore the working current should be determined by means of the well-known Kelvin rule.

In the case of extra high tension cable, however, the economical current may be greater than that corresponding to the safe working temperature of the cable, therefore the working current has to be calculated on the basis of the safe working temperature.

Tables Nos. 13 and 14 (Chapter I.) give the values of the current for various copper conductors according to the old "rule" of 1000 amperes per square inch, and also according to the rule of the Institution of Electrical Engineers for conductors laid in casing or tubing, viz.:—

$$\text{Log } c = 0 \cdot 82 \log \text{A} + 0 \cdot 415$$

or

$$c = 2 \cdot 6 \text{ A}^{0 \cdot 82}$$

where c is the current in amperes, and A is the sectional area of copper in thousandths of a square inch.

Table No. 203 gives the maximum allowable current for various cables as recommended by the Verband Deutscher Elektrotechniker; the values given for the underground cables are allowable when the cables are laid direct in the earth. For unfavourable conditions, such as when more than two cables are laid together, or when the cables are laid in ducts, it is advisable to allow only 75 per cent. of the values given.

Installation Wires.—Kennelly gives the following formula for determining the allowable current for installation cables enclosed in wood casing—

$$\text{I} = 560\, d^{\frac{3}{2}}$$

or

$$\text{I} = 138\, \text{D}^{\frac{3}{2}}$$

where I is the current allowable for a temperature rise of 14° C., d is the diameter of the copper conductor in inches, and D is the diameter of the copper conductor in centimetres. Heavily insulated wires armoured or laid in ducts radiate heat more readily than wires enclosed in wood casings.

Underground Cables.—From the results of numerous experiments, Apt and Mauritius give the following empirical formula for determining the current allowable in underground cables :—

$$I = \sqrt{\frac{tQ}{e}}$$

where t is the allowable rise of temperature in degrees Centigrade, Q is the area of the conductor in square millimetres, I the allowable current in amperes, and e a constant depending upon the type of cable. When more than one cable are laid together, the safe value for t will be about 15° C. The values of e for a temperature rise of 15° C. are given as:—

Single Cables	$e = 1 \times 0{\cdot}018 = 0{\cdot}018$
Concentric and twin cables	$e = 2 \times 0{\cdot}018 = 0{\cdot}036$
Triple concentric and three-core cables ..	$e = 3 \times 0{\cdot}018 = 0{\cdot}054$
Four-core cables	$e = 4 \times 0{\cdot}018 = 0{\cdot}072$

TABLE No. 203.—CURRENT-CARRYING CAPACITY OF CABLES IN AMPERES. As recommended by the Verband Deutscher Elektrotechniker.

Cross Section of Conductor		Underground Cables—(see note)									Installation Cables up to 1000 Volts
sq. mm.	sq. in.	Single Core up to 700 Volts	Twin Core up to 3000 Volts	Twin Core up to 10,000 Volts	Twin Core up to 3000 Volts	Three Core up to 10,000 Volts	Four Core up to 3000 Volts	Four Core up to 10,000 Volts	Concentric up to 3000 Volts	Triple Concentric up to 3000 Volts	
0·75	0·001162	..	..	..	..	..	..	..	..	..	9
1·0	·00155	24	..	..	..	..	..	..	..	..	11
1·5	·002325	31	..	..	..	..	..	..	..	..	14
2·5	·003875	41	..	..	..	..	..	..	..	..	20
4	·0062	55	42	..	37	..	34	..	..	..	25
6	·0093	70	53	..	47	..	43	..	..	..	31
10	·0155	95	70	65	65	60	57	55	70	55	43
16	·0248	130	95	90	85	80	75	70	90	75	75
25	·0387	170	125	115	110	105	100	95	120	100	100
35	·0542	210	150	140	135	125	120	115	145	120	125
50	·0775	260	190	175	165	155	150	140	180	150	160
70	·1085	320	230	215	200	190	185	170	220	185	200
95	·147	385	275	255	240	225	220	205	270	220	240
120	·186	450	315	290	280	260	250	240	310	255	280
150	·232	510	360	335	315	300	290	275	360	290	325
185	·286	575	405	380	360	340	330	310	405	330	380
240	·372	670	470	..	420	..	385	..	470	385	450
310	·480	785	545	..	490	..	445	..	550	455	540
400	·620	910	635	..	570	..	..	..	645	530	640
500	·775	1035	..	..	..	..	..	..	..	..	760
625	·968	1190	..	..	..	..	..	..	..	..	880
800	1·240	1380	..	..	..	..	..	..	..	..	1050
1000	1·550	1585	..	..	..	..	..	..	..	..	1250

The relation between current and temperature in underground cables has been very thoroughly investigated by Teichmuller and Humann (*see* various communications to the "Elektrotechnischer Zeitschrift") who give the formula—

$$I = \frac{c}{\sqrt{\nu \rho_\tau}} \sqrt{\left\{ \frac{Q \tau}{\sigma_{\kappa\tau} \log_{10}\left(\frac{Da^1}{Di^1}\right) + \sigma_{n\tau} \log_{10}\left(\frac{4l}{Da}\right)} \right\}}$$

where I = amperes per conductor.

$$c = \sqrt{\frac{2\pi\, 10^{-2}}{2 \cdot 303 \times 10^{-4}}} = 16 \cdot 52$$

ν = number of conductors.
ρ_τ = specific resistance of the conducting material in ohms per metre/square millimetre at the temperature corresponding to the temperature rise of $\tau°$ Centigrade.
Q = cross section of each conductor in square millimetres.
τ = temperature rise in degrees Centigrade.
$\sigma_{\kappa\tau}$ = specific resistance to heat for the insulating material in electrical units.
$\sigma_{n\tau}$ = specific resistance to heat for the earth in which the cable is laid in electrical units.
Da^1 = reduced overall diameter of cable.
l = depth in millimetre at which the cable is laid.
Di^1 = diameter of the copper enclosing circle reduced to the basis of a single cable.
Da = diameter overall.

The specific resistance of copper in ohms per metre/square millimetre at 15° Centigrade, which may be regarded as the maximum summer temperature at a depth of about one metre, is equal to—

$$\rho_{15} = 0 \cdot 0175$$

therefore $$\rho_\tau = (1 + 0 \cdot 004\,\tau)\; 0 \cdot 0175$$

If the safe working temperature of the cable be taken as 40° Centigrade, then the allowable temperature rise will be 25° Centigrade.

$$\therefore \quad \rho_\tau = \{1 + 25\,(0 \cdot 004)\}\; 0 \cdot 0175 = 0 \cdot 01925$$

$\sigma_{\kappa\tau}$ the specific heat resistance of the insulating and worming material has been found from experiments to be for paper and jute—

For single conductor low tension cable $\sigma_{\kappa\tau} = 650$
For multicore low tension cable .. $\sigma_{\kappa\tau} = 600$
For multicore high tension cable .. $\sigma_{\kappa\tau} = 550$

and $\sigma_{n\tau}$ for earth can be taken to average 50.

l, the depth of the cable can be taken as approximately 700 millimetres.

Da^1, the reduced overall diameter of the cable, is equal to—

$$\frac{D_1}{D_2} \cdot \frac{D_3}{D_4} \cdot Da$$

where D_1 = diameter under the lead sheath.
D_2 = diameter over the lead sheath.
D_3 = diameter under the metallic armour.
D_4 = diameter over the metallic armour.
Da = diameter over the outer jute serving.

$D\,i$, the diameter of the substituted single conductor, has been calculated by Professor Mie, who gives the formula—

$$D_{i1} = D_i \sqrt[\nu]{\frac{\nu \rho}{R_i + (\nu - \iota)\rho}}$$

where R_i = radius of the copper enclosing circle.
$D_i = 2 R_i$.
ρ = radius of any one conductor.
ν = number of conductors.

By assuming an allowable rise of temperature to 40° C. with paper or jute insulated copper conductors laid 70 centimetres deep, the formula reduces to—

$$I = \frac{119}{\sqrt{\nu}} \sqrt{\left\{\frac{25\,Q}{550 \log_{10}\left(\frac{D_{a1}}{D_{i1}}\right) + 50 \log_{10}\left(\frac{2800}{D_a}\right)}\right\}}$$

Or for single conductor cables—

$$I = 119 \sqrt{\frac{25\,Q}{550 \log_{10}\left(\frac{D_{a1}}{D_i}\right) + 50 \log_{10}\left(\frac{2800}{D_a}\right)}}$$

For 2-core cables—

$$I = 84 \sqrt{\frac{25\,Q}{550 \log_{10}\left(\frac{D_{a1}}{D_{i1}}\right) + 50 \log_{10}\left(\frac{2800}{D_a}\right)}}$$

For 3-core cables—

$$I = 68 \cdot 7 \sqrt{\frac{25\,Q}{550 \log_{10}\left(\frac{D_{a1}}{D_{i1}}\right) + 50}}$$

In addition to the heating effect of the current, upon which the above formula is founded, there will be further heating effects due to the eddy current losses in the conductor and lead sheath and to dielectric losses, in total from 6 to 10 per cent. of the C^2R loss.

The following example shows the application of the formula; 3 × 0·05 square inch paper insulated cable to following specification:—

19 × 1·47 mm. copper wires	diameter	=	7·35
Paper 14 mm. between conductors . . .	,,	=	21·35
Three cores laid up together and wormed . .	,,	=	46·00
Paper 14 mm. between copper and lead . .	,,	=	60·00
Lead 3·5 mm. thick	,,	=	67·00
Jute serving	,,	=	71·00
Two steel tapes 55 × 1·1 mm. . . .	,,	=	75·4
Jute serving	,,	=	79·4

$Q = 32 \cdot 2$ sq. mm.

$$D_{a1} = \frac{60}{67} \cdot \frac{71}{75 \cdot 4} \cdot 79 \cdot 4 = 67 \cdot 0 \text{ mm.}$$

$$D_{i1} = 18 \sqrt[3]{\frac{3 \times 3 \cdot 675}{9 + 7 \cdot 35}} = 15 \cdot 84 \text{ mm.}$$

$$D_a = 79 \cdot 4$$

$$\therefore I = 68 \cdot 7 \sqrt{\left\{\frac{25 \times 32 \cdot 2}{550 \log_{10} \frac{67}{15 \cdot 84} + 50 \log_{10} \frac{2800}{79 \cdot 4}}\right\}} = 95 \text{ amperes.}$$

Allowing 5 per cent. for the losses in dielectric, lead, etc., we obtain 90 amperes as the maximum allowable current.

If I is the allowable current for a single conductor cable, then 0·74 I can be taken as the maximum allowable current for the corresponding concentric cable and 0·66 I for the corresponding triple concentric cable.

Voltage Stress in Alternate Current Cables.

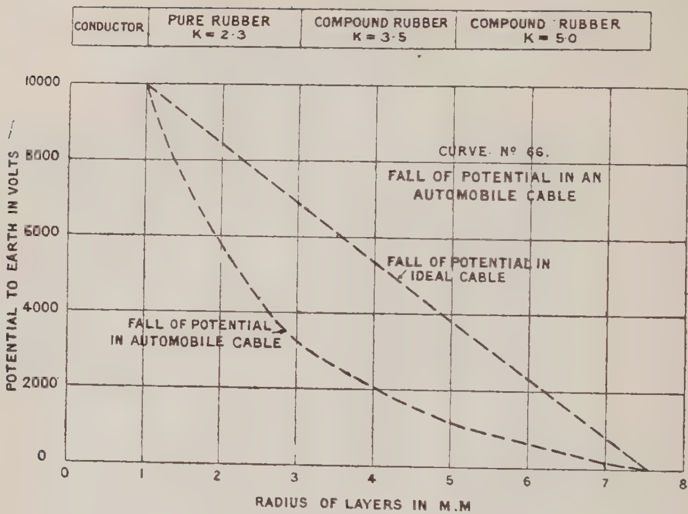
If an alternating voltage be applied to an insulated conductor, the fall of potential across any concentric layer of the dielectric will be inversely proportional to the electrostatic capacity of that layer. In the case of single and concentric conductor cables, the capacity of any layer of the dielectric is directly proportional to the value of the dielectric constant of the dielectric, and inversely proportional to the value of $\log \frac{D}{d}$, where D is the external and d the internal diameter of the layer; therefore, proceeding in layers from the conductor outwards, the value of $\log \frac{D}{d}$ decreases in value, and consequently the capacity increases, assuming a homogeneous dielectric; the electric stress will therefore be a maximum near the conductor and a minimum at the outer surface of the dielectric. It follows that in order to use the dielectric economically, the value of the dielectric constant ought to decrease as the value of $\log \frac{D}{d}$ decreases, so that the capacity of each layer be equal, and therefore the electric stress equal throughout the dielectric.

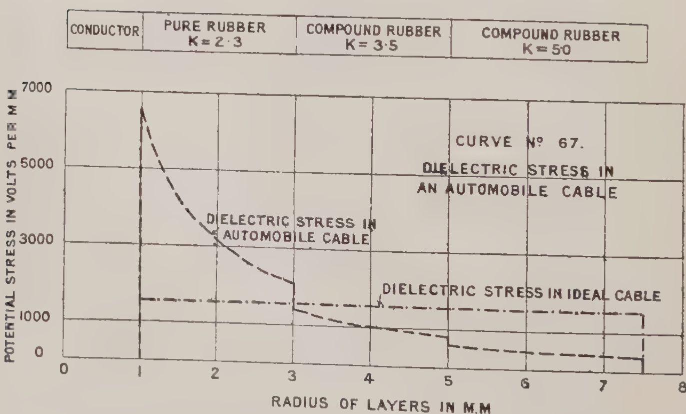
This method of making the capacity of the successive layers equal, known as "grading" has been worked out by O'Gorman, Jona, Russell and others.

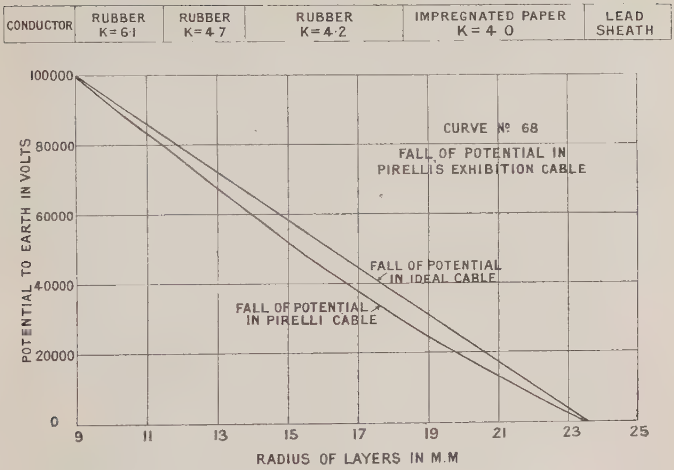
Table No. 204.—Dielectric Details of an Automobile Cable, Rubber Insulated.

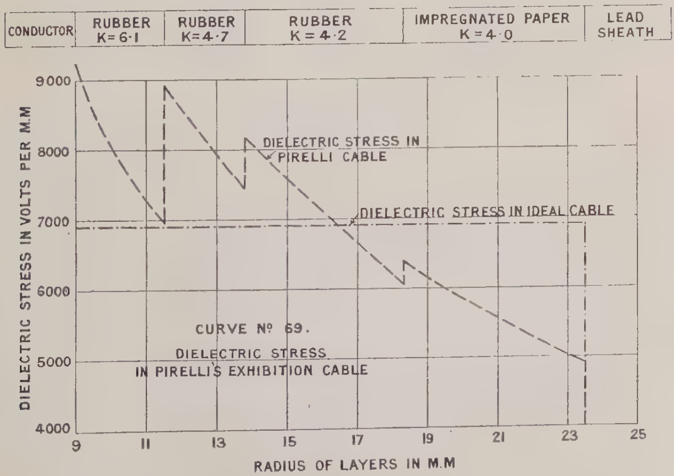
Dielectric	Radii of the Layer: Inner	Radii of the Layer: Outer	Dielectric Constant	Capacity of Layer, Micro-farads per km.	Relative Stress	Voltage Distribution at 10,000 Volts	Potential to Earth in Volts	Dielectric Stress in Volts per mm.
Conductor..	0	1	..	..	..	..	10000	0
Pure Rubber	1	1·5	2·3	0·315	1000	2510	7490	5020
"	1·5	2·0	2·3	·446	705	1766	5724	3532
"	2·0	2·5	2·3	·574	550	1378	4346	2756
"	2·5	3·0	2·3	·703	450	1127	3219	2254
Separator ..	3·0	3·5	3·5	1·272	248	622	2597	1244
" ..	3·5	4·0	3·5	1·460	216	542	2055	1084
" ..	4·0	4·5	3·5	1·65	191	479	1576	958
" ..	4·5	5·0	3·5	1·85	170	427	1149	854
Jacket ..	5·0	5·5	5·0	2·93	108	271	878	542
" ..	5·5	6·0	5·0	3·19	99	248	630	496
" ..	6·0	6·5	5·0	3·49	90	226	404	452
" ..	6·5	7·0	5·0	3·76	84	211	193	422
" ..	7·0	7·5	5·0	4·06	77	193	0	386
				Total =	3988			

Note.—This cable broke down at 34,000 volts effective.


CONDUCTOR
PURE RUBBER K = 2·3
COMPOUND RUBBER K = 3·5
COMPOUND RUBBER K = 5·0
CURVE Nº 66.
FALL OF POTENTIAL IN AN AUTOMOBILE CABLE
FALL OF POTENTIAL IN IDEAL CABLE
FALL OF POTENTIAL IN AUTOMOBILE CABLE
POTENTIAL TO EARTH IN VOLTS
10000
8000
6000
4000
2000
0
0 1 2 3 4 5 6 7 8
RADIUS OF LAYERS IN M.M


CONDUCTOR
PURE RUBBER K = 2·3
COMPOUND RUBBER K = 3·5
COMPOUND RUBBER K = 5·0
CURVE Nº 67.
DIELECTRIC STRESS IN AN AUTOMOBILE CABLE
DIELECTRIC STRESS IN AUTOMOBILE CABLE
DIELECTRIC STRESS IN IDEAL CABLE
POTENTIAL STRESS IN VOLTS PER M M
7000
5000
3000
1000
0
0 1 2 3 4 5 6 7 8
RADIUS OF LAYERS IN M.M


CONDUCTOR
RUBBER K=6·1
RUBBER K=4 7
RUBBER K=4·2
IMPREGNATED PAPER K=4 0
LEAD SHEATH
CURVE Nº 68
FALL OF POTENTIAL IN PIRELLI'S EXHIBITION CABLE
FALL OF POTENTIAL IN IDEAL CABLE
FALL OF POTENTIAL IN PIRELLI CABLE
POTENTIAL TO EARTH IN VOLTS
100000
80000
60000
40000
20000
0
9
11
13
15
17
19
21
23
25
RADIUS OF LAYERS IN M.M


CONDUCTOR
RUBBER K=6·1
RUBBER K=4·7
RUBBER K=4·2
IMPREGNATED PAPER K=4·0
LEAD SHEATH
DIELECTRIC STRESS IN PIRELLI CABLE
DIELECTRIC STRESS IN IDEAL CABLE
CURVE Nº 69.
DIELECTRIC STRESS IN PIRELLI'S EXHIBITION CABLE
DIELECTRIC STRESS IN VOLTS PER M.M
9000
8000
7000
6000
5000
4000
9
11
13
15
17
19
21
23
25
RADIUS OF LAYERS IN M.M

When the insulation of the conductor consists of various materials having various dielectric constants, the distribution of the electric potential can be determined as shown in Table No. 204, which at the same time shows the waste of material in the ordinary type of automobile cable. The capacity of each layer is first calculated, and the relative stress determined inversely proportional to the capacity; the total "relative" stress is then equated to the total voltage and the actual dielectric stress determined for each layer.

Curve No. 66 shows the fall of potential, and Curve No. 67 the distribution of the dielectric stress of the automobile cable.

Table No. 205, and Curves Nos. 68 and 69, give the distribution of potential and dielectric stress for the Pirelli exhibition cable working at 100,000 volts; it must be remembered that a dielectric stress of 9000 volts per millimetre for india-rubber, and 6000 volts per millimetre for paper, is hardly allowable in any commercial cable, for the factor of safety in the one case is less than 3 and in the other slightly more than 3.

TABLE No. 205.—DIELECTRIC DETAILS OF MESSRS. PIRELLI'S MILAN EXHIBITION CABLE.

Dielectric	Radii of the Layer		Dielectric Constant	Capacity of the Layer, Microfarads per km.	Relative Stress	Voltage Distribution at 100,000 Volts	Potential to Earth in Volts	Dielectric Stress in Volts per mm.
	Inner	Outer						
Conductor . .	0	9	. .	. .	. .	. .	100000	0
Rubber . .	9	9·5	6·1	6·13	1000	4470	95530	8940
,, . .	9·5	10	6·1	6·68	918	4100	91430	8200
,, . .	10	10·5	6·1	7·00	876	3910	87520	7820
,, . .	10·5	11	6·1	7·36	833	3720	83800	7440
,, . .	11	11·5	6·1	7·74	793	3540	80260	7080
Rubber . .	11·5	12	4·7	6·29	975	4350	75910	8700
,, . .	12	12·5	4·7	6·51	942	4200	71710	8400
,, . .	12·5	13·0	4·7	6·74	910	4055	67655	8110
,, . .	13	13·5	4·7	7·08	867	3870	63785	7740
,, . .	13·5	13·8	4·7	12·2	503	2240	61545	7466
Rubber . .	13·8	14	4·2	16·9	363	1620	59925	8100
,, . .	14	14·5	4·2	6·79	904	4030	55895	8060
,, . .	14·5	15	4·2	7·13	860	3840	52055	7680
,, . .	15·0	16	4·2	3·67	1670	7450	44605	7450
,, . .	16	17	4·2	3·89	1576	7030	37575	7030
,, . .	17	18	4·2	4·12	1488	6645	30930	6645
,, . .	18	18·3	4·2	15·1	406	1810	29120	6033
Paper . .	18·3	19	4·0	6·25	981	4380	24740	6257
,, . .	19	20	4·0	4·6	1334	5960	18780	5960
,, . .	20	21	4·0	4·82	1273	5696	13084	5696
,, . .	21	22	4·0	5·06	1211	5414	7670	5414
,, . .	22	23	4·0	5·33	1151	5150	2520	5150
,, . .	23	23·5	4·0	10·88	564	2520	0	5040
				Total =	22398			

Extra High Tension Cables.—The size of the copper conductor for ordinary high and low tension cable is determined by the current required to be transmitted, or by the allowable or economical drop of potential. In the case of extra high tension cables the size of the conductor may also be governed by the working pressure, by the safety factor allowed, and by the dielectric used.

Let R be the radius over the dielectric in millimetres.
r be the radius over the conductor in millimetres.
V be the working pressure in volts.
S be the maximum allowable dielectric stress in volts per millimetre.

Then the electric stress at any point distant x millimetres from the centre of the conductor will be equal to—

$$\frac{V}{x \log_\epsilon \frac{R}{r}}$$

If the dielectric be homogeneous, then the electric stress on the dielectric will be a maximum at the surface of the conductor, that is, when $x = r$, therefore the maximum stress will be—

$$\frac{V}{r \log_\epsilon \frac{R}{r}}$$

Therefore the cable must be so proportioned that

$$\frac{V}{r \log_\epsilon \frac{R}{r}} = S$$

$$\text{that is} \quad \frac{R}{r} = \epsilon^{\frac{V}{rS}} \quad \text{that is} \quad \frac{R}{r} = \epsilon^{\frac{T}{r}}$$

where $T = \frac{V}{S}$, or equal to the thickness in millimetres of a plane sheet of the dielectric necessary for the working pressure of V volts.

Therefore

$$\frac{dR}{dr} = \epsilon^{\frac{T}{r}}\left(1 - \frac{T}{r}\right),$$

therefore, if r is greater than T, then $\frac{dR}{dr}$ will be positive, and as the radius of the conductor increases, so the radius over the dielectric must be increased, as is the case with low tension and ordinary high tension cables. If, however, T is greater than r, then $\frac{dR}{dr}$ will be negative, and therefore the radius over the dielectric (R) will *decrease* as the radius of the conductor is increased until $r = T$.

Therefore, for any given values of the working pressure and maximum allowable dielectric stress, the smallest overall radius will be obtained when

$$r = \frac{V}{S} = T$$

the radius over the dielectric in this case will be

$$R = r(\epsilon)^{\frac{T}{r}} = 2{\cdot}7183\,r.$$

As the radius of the conductor is further increased, so the radius over the dielectric will increase, but the quantity of insulating material will not reach its minimum value until the radius of the conductor reaches the value $r = 1 \cdot 254$ T as shown by Alex Russell (Paper read before the Institution of Electrical Engineers, November 14, 1907). As, however, the quantity of sheathing material increases with the diameter over the dielectric, therefore the "economical" radius of the conductor lies between T and $1 \cdot 254$ T in value.

Allowable Stress in Paper Cables.—The safe commercial working pressure for any extra high tension cable can be experimentally determined by measuring the dielectric losses with increasing voltages. The curve plotted from these values shows the relation between dielectric loss and voltage to be fairly proportional up to a certain value of the voltage, beyond which the loss increases very rapidly. Experiments carried out on a three-core cable with 70 sq. mm. conductors insulated with $12 \cdot 5$ mm. of paper copper to copper and copper to lead sheath, showed the maximum safe working pressure to be approximately 19,000 volts, from which the maximum stress per mm. is found to be—

$$S = \frac{V}{r \log_\epsilon \frac{R}{r}} = \frac{19{,}000}{5 \cdot 1 \log_\epsilon \frac{17 \cdot 6}{5 \cdot 1}} = 3000 \text{ volts per mm.}$$

Further tests were carried out on three-core cable with $0 \cdot 05$ sq. in. conductors insulated with 16 mm. of paper copper to copper and also copper to lead sheath, from which the safe working pressure appeared to be 20,000 volts.

$$\therefore \quad S = \frac{20{,}000}{3 \cdot 9 \log_\epsilon \frac{19 \cdot 9}{3 \cdot 9}} = 3140 \text{ volts per mm.}$$

Numerous breakdown tests on paper insulated cables show the average dielectric strength to be 20,000 volts per mm.; therefore, by taking 3000 volts/mm. as the working pressure, the factor of safety appears to be $6 \cdot 6$.

The minimum diameter of conductor for impregnated paper cable can now be calculated for any working pressure; for example, for a working pressure of 40,000 volts, the minimum radius of conductor will be

$$= \frac{V}{S} = \frac{40{,}000}{3000} = 13 \cdot 3 \text{ mm.}$$

which corresponds approximately to $0 \cdot 6$ sq. in. section.

If therefore it is required to construct an impregnated paper cable for 40,000 volts working pressure, the conductor should be given an overall diameter of $26 \cdot 6$ millimetres, irrespective of the necessary copper section; this can be done by either (i) using a conductor of copper wires of approximately $0 \cdot 6$ square inch cross-section, which will be out of the question unless it is required to transmit 300 to 500 amperes, or (ii) using a conductor of lower conductivity than copper, such as aluminium, or (iii) stranding the requisite number of copper or aluminium wires round a dummy centre of jute, hemp or like material. The method to be adopted will, of course, depend upon the relation between the minimum diameter of the conductor and the diameter of the copper strand necessary to transmit the required current, and also upon the relative prices of copper, aluminium, etc. The dummy centre might be lapped with thick paper, then the copper wires stranded on, and finally the whole covered with a thin tube of lead.

Table No. 206 shows the minimum diameters of conductor for various working pressures calculated for impregnated paper insulated cables, and also the approximate area of the conductor strand corresponding to these diameters.

TABLE No. 206.—MINIMUM DIAMETERS OF CONDUCTORS.

Working Pressure in Volts	$\frac{V}{S}$	Diameter of Conductor in mm.	Approximate corresponding effectual Area of Conductor Strand in sq. in.
15,000	5·00	10·0	0·093
20,000	6·66	13 3	0·16
25,000	8·34	16·7	0·25
30,000	10·00	20·0	0·37
35,000	11·66	23·3	0·50
40,000	13·30	26·6	0·62
45,000	15·00	30·0	0·94
50,000	16·68	33·4	1·00

Table No. 207 gives the corresponding diameters over the paper insulation and also the thicknesses of the dielectric, from which values it appears that assuming a factor of safety of 6 to 7, the maximum working pressure allowable for single conductor impregnated paper cable is 35,000 to 40,000 volts. This can, of course, be increased to 70,000 to 80,000 volts for single phase working, by using two single conductor cables having their lead sheaths earthed, the transformers feeding the cables being also earthed at their centre points.

TABLE No. 207.—DIMENSIONS OF DIELECTRIC.

Working Pressure in Volts	Diam. over the Dielectric in mm. $= 2{\cdot}7183\ d.$	Radial Thickness of Dielectric, mm.
15,000	27·2	8·60
20,000	36·2	11·45
25,000	45·4	14·35
30,000	54·4	17·20
35,000	63·4	20·05
40,000	72·3	22·85
45,000	81·6	25·80
50,000	90·8	28·70

CABLE DRUMS.

In cable works it is the usual practice to have standard sizes of drums, at least for the larger cables. The dimensions of such a series of drums are given in Table No. 208.

Table No. 209 gives the manufacturing lengths of cables of various diameters, and the drum of the above series on which they would be packed.

Table No. 210 gives the length of cable of various diameters which can be packed on each of the drums in the above series; such a table is useful for exceptional cases.

TABLE No. 208.—STANDARD CABLE DRUMS.

Drum No.	Dimensions in mm.			Approximate Weight of Drum, kilog.	Approximate Weight of the Lagging, kilog.
	Flange	Body	Width		
I.	2000	1500	800	605	45
II.	1750	1250	800	420	40
III.	1500	1000	800	316	30
IV.	1250	750	800	250	24

TABLE No. 209.—MANUFACTURING LENGTHS OF VARIOUS CABLES, COILED ON STANDARD DRUMS.

On Drum I.		On Drum II.		On Drum III.	
Diam. of Cable, mm.	Length of Cable in metres	Diam. of Cable, mm.	Length of Cable in metres	Diam. of Cable, mm.	Length of Cable in metres
82	150	54	260	36	485
81	150	53	275	35	500
80	150	52	275	34	510
79	150	51	270	33	530
78	150	50	277	32	540
77	150	49	290	31	660
76	150	48	290	30	670
75	160	47	293	29	725
74	160	46	310	28	725
73	160	45	335	27	885
72	170	44	396	26	930
71	175	43	410	25	930
70	175	42	420	24	1085
69	175	41	430	23	1160
68	175	40	435	22	1340
67	175	39	460	21	1420
66	180	38	460	20	1640
65	190	37	485	19	1720
64	190	..	..	18	1950
63	193	..	..	17	2559
62	260	..	..	16	2917
61	260	..	..	15	3360
60	280	..	..	..	..
59	280	..	..	..	..
58	280	..	..	..	..
57	280	..	..	..	
56	300	..	..	..	..
55	300	..	..	..	..

TABLE No. 210.—LENGTH OF CABLE ON DRUMS.

Diam. of Cable, mm.	No. of Layers	No. of Rings in each Layer	Mean Circumference				Length of Cable in Metres			
			Drum I.	Drum II.	Drum III.	Drum IV.	Drum I.	Drum II.	Drum III.	Drum IV.
10	25	81	5·5	4·71	3·93	3·14	11137	9537	7958	6358
11	22	73	5·47	4·68	3·90	3·11	8784	7516	6263	4994
12	20	67	5·46	4·68	3·89	3·11	7316	6271	5212	4167
13	19	62	5·49	4·70	3·92	3·13	6467	5536	4617	3687
14	17	57	5·46	4·67	3·89	3·10	5290	4525	3769	3003
15	16	54	5·46	4·68	3·89	3·11	4717	4043	3360	2687
16	15	50	5·46	4·68	3·89	3·11	4095	3510	2917	2332
17	14	47	5·46	4·67	3·89	3·10	3592	3072	2559	2039
18	13	45	5·44	4·66	3·87	3·09	3182	2726	2263	1807
19	13	42	5·49	4·70	3·92	3·13	2997	2566	2140	1708
20	12	40	5·46	4·68	3·89	3·11	2620	2246	1867	1492
21	11	38	5·44	4·65	3·86	3·08	2273	1943	1613	1287
22	11	36	5·47	4·68	3·90	3·11	2166	1853	1544	1231
23	10	35	5·43	4·65	3·86	3·08	1900	1627	1351	1078
24	10	33	5·46	4·68	3·89	3·11	1801	1544	1283	1026
25	10	32	5·5	4·71	3·93	3·14	1760	1507	1257	1004
26	9	31	5·44	4·66	3·87	3·09	1517	1300	1079	862
27	9	30	5·47	4·69	3·90	3·12	1476	1266	1053	842
28	8	28	5·41	4·63	3·84	3·06	1211	1037	860	685
29	8	28	5·44	4·65	3·87	3·08	1218	1041	866	689
30	8	27	5·46	4·68	3·89	3·11	1179	1010	840	671
31	8	26	5·49	4·70	3·92	3·13	1141	977	815	651
32	7	25	5·41	4·63	3·84	3·06	946	810	672	535
33	7	24	5·44	4·65	3·87	3·08	913	781	650	517
34	7	23	5·46	4·67	3·88	3·10	879	751	624	499
35	7	23	5·48	4·69	3·90	3·12	882	755	627	502
36	6	22	5·39	4·69	3·81	3·03	771	619	502	399
37	6	21	5·41	4·62	3·84	3·05	681	582	484	384
38	6	21	5·43	4·64	3·85	3·07	684	584	485	386
39	6	20	5·44	4·65	3·87	3·08	652	558	464	369
40	6	20	5·46	4·68	3·89	3·10	655	561	466	372
41	6	19	5·48	4·69	3·91	3·12	624	534	445	355
42	5	19	5·37	4·58	3·79	3·01	510	435	360	285
43	5	18	5·39	4·60	3·81	3·03	485	414	342	272
44	5	18	5·40	4·61	3·83	3·05	486	414	344	274
45	5	18	5·42	4·63	3·84	3·06	487	416	345	275
46	5	17	5·43	4·64	3·86	3·07	451	394	328	260
47	5	17	5·44	4·66	3·87	3·09	462	396	338	262
48	5	16	5·46	4·68	3·89	3·10	436	374	311	248
49	5	16	5·47	4·69	3·90	3·12	437	375	312	249
50	5	16	5·49	4·71	3·93	3·14	437	376	314	251
51	4	15	5·35	4·56	3·78	2·99	321	273	226	179
52	4	15	5·36	4·57	3·79	3·00	321	274	227	180

TABLE No. 210.—LENGTH OF CABLE ON DRUMS—*continued.*

Diam. of Cable, mm.	No. of Layers	No. of Rings in each Layer	Mean Circumference				Length of Cable in Metres			
			Drum I.	Drum II.	Drum III.	Drum IV.	Drum I.	Drum II.	Drum III.	Drum IV.
53	4	15	5·37	4·59	3·80	3·02	322	275	228	181
54	4	15	5·38	4·60	3·81	3·03	322	276	228	181
55	4	14	5·40	4·61	3·83	3·04	302	258	214	170
56	4	14	5·41	4·62	3·84	3·05	302	258	215	170
57	4	14	5·42	4·64	3·86	3·07	303	259	216	171
58	4	13	5·43	4·65	3·86	3·08	304	260	216	172
59	4	13	5·43	4·66	3·88	3·09	282	242	201	160
60	4	13	5·46	4·68	3·89	3·10	283	243	202	161
61	4	13	5·47	4·69	3·90	3·12	284	243	202	162
62	4	13	5·48	4·70	3·91	3·13	284	244	203	162
63	3	12	5·33	4·52	3·73	2·94	191	162	134	105
64	3	12	5·31	4·52	3·74	2·95	191	162	134	106
65	3	12	5·32	4·53	3·75	2·96	191	163	135	106
66	3	12	5·33	4·54	3·76	2·97	191	163	135	106
67	3	12	5·34	4·55	3·77	2·98	192	163	135	107
68	3	11	5·35	4·56	3·78	2·99	176	150	124	98
69	3	11	5·35	4·57	3·78	3·00	176	150	124	99
70	3	11	5·36	4·58	3·79	3·01	176	151	125	99
71	3	11	5·37	4·59	3·80	3·02	177	151	125	99
72	3	11	5·38	4·60	3·81	3·03	177	151	125	99
73	3	11	5·39	4·61	3·82	3·04	177	152	126	100
74	3	10	5·40	4·62	3·83	3·05	162	138	114	91
75	3	10	5·41	4·63	3·84	3·06	162	138	115	91
76	3	10	5·42	4·64	3·85	3·07	162	139	115	92
77	3	10	5·43	4·65	3·86	3·08	162	139	115	92
78	3	10	5·44	4·65	3·87	3·09	163	139	115	92
79	3	10	5·45	4·66	3·88	3·09	163	139	116	92
80	3	10	5·46	4·67	3·89	3·10	163	140	116	99
81	3	9	5·47	..	..	..	148	..	..	..
82	3	9	5·48	..	..	..	148	..	..	..
83	3	9	5·49	..	..	..	148	..	..	..
84	2	9	5·23	..	..	..	92	..	..	..
85	2	9	5·24	..	..	..	92	..	..	..
86	2	9	5·25	..	..	..	92	..	..	..
87	2	9	5·25	..	..	..	92	..	..	..

CONVERSIONS.

Millimetres to inches .. .. .. *See* Table No. 105, page 210.
Inches to millimetres .. .. .. *See* Table No. 6, page 55.
Square millimetres to square inches .. *See* Table No. 2, page 24.
Square inches to square millimetres .. *See* Table No. 1, page 2.
Circumferences of Circles .. .. .. *See* Table No. 86, page 181.
Areas of Circles .. .. *See* Table No. 60, page 137.

TABLE No. 211.—YARDS TO METRES.

Yards	Metres	Yards	Metres	Yards	Metres	Yards	Metres
1	0·914	26	23·774	51	46·634	76	69·494
2	1·829	27	24·688	52	47·548	77	70·408
3	2·743	28	25·603	53	48·463	78	71·322
4	3·658	29	26·517	54	49·377	79	72·237
5	4·572	30	27·432	55	50·291	80	73·151
6	5·486	31	28·346	56	51·206	81	74·066
7	6·401	32	29·260	57	52·120	82	74·980
8	7·315	33	30·175	58	53·035	83	75·894
9	8·229	34	31·089	59	53·949	84	76·809
10	9·144	35	32·004	60	54·863	85	77·723
11	10·058	36	32·918	61	55·778	86	78·637
12	10·973	37	33·832	62	56·692	87	79·552
13	11·887	38	34·747	63	57·607	88	80·466
14	12·801	39	35·661	64	58·521	89	81·381
15	13·716	40	36·576	65	59·435	90	82·295
16	14·630	41	37·490	66	60·350	91	83·209
17	15·545	42	38·404	67	61·264	92	84·124
18	16·459	43	39·319	68	62·178	93	85·038
19	17·373	44	40·233	69	63·093	94	85·953
20	18·288	45	41·147	70	64·007	95	86·867
21	19·202	46	42·062	71	64·922	96	87·781
22	20·117	47	42·976	72	65·836	97	88·696
23	21·031	48	43·891	73	66·750	98	89·610
24	21·945	49	44·805	74	67·665	99	90·525
25	22·860	50	45·719	75	68·579	100	91·439

TABLE No. 212.—METRES TO YARDS.

Metres	Yards	Metres	Yards	Metres	Yards	Metres	Yards
1	1·094	26	28·434	51	55·775	76	83·115
2	2·188	27	29·528	52	56·868	77	84·209
3	3·281	28	30·621	53	57·962	78	85·302
4	4·374	29	31·715	54	59·055	79	86·396
5	5·468	30	32·809	55	60·149	80	87·490
6	6·562	31	33·902	56	61·243	81	88·583
7	7·655	32	34·996	57	62·336	82	89·677
8	8·749	33	36·089	58	63·430	83	90·770
9	9·843	34	37·183	59	64·524	84	91·864
10	10·936	35	38·277	60	65·617	85	92·958
11	12·030	36	39·370	61	66·711	86	94·051
12	13·123	37	40·464	62	67·804	87	95·145
13	14·217	38	41·558	63	68·898	88	96·239
14	15·311	39	42·651	64	69·992	89	97·332
15	16·404	40	43·745	65	71·085	90	98·426
16	17·498	41	44·838	66	72·179	91	99·519
17	18·591	42	45·932	67	73·272	92	100·613
18	19·685	43	47·026	68	74·366	93	101·707
19	20·779	44	48·119	69	75·460	94	102·800
20	21·872	45	49·213	70	76·553	95	103·894
21	23·966	46	50·306	71	77·647	96	104·987
22	24·060	47	51·400	72	78·741	97	106·081
23	25·153	48	52·494	73	79·834	98	107·175
24	26·217	49	53·587	74	80·928	99	108·268
25	27·340	50	54·681	75	82·021	100	109·362

TABLE No. 213.—LB. TO KILOGRAMMES.

Lb.	Kilog.	Lb.	Kilog.	Lb.	Kilog.	Lb.	Kilog.
1	0·454	26	11·793	51	23·133	76	34·473
2	0·907	27	12·247	52	23·587	77	34·927
3	1·361	28	12·701	53	24·040	78	35·380
4	1·814	29	13·154	54	24·494	79	35·834
5	2·268	30	13·608	55	24·948	80	36·287
6	2·722	31	14·061	56	25·401	81	36·741
7	3·175	32	14·515	57	25·855	82	37·195
8	3·629	33	14·969	58	26·308	83	37·648
9	4·082	34	15·422	59	26·762	84	38·102
10	4·536	35	15·876	60	27·252	85	38·555
11	4·989	36	16·329	61	27·669	86	39·009
12	5·443	37	16·783	62	28·123	87	39·463
13	5·897	38	17·236	63	28·576	88	39·916
14	6·350	39	17·690	64	29·030	89	40·370
15	6·804	40	18·144	65	29·483	90	40·823
16	7·257	41	18·597	66	29·937	91	41·277
17	7·711	42	19·051	67	30·391	92	41·731
18	8·165	43	19·504	68	30·844	93	42·184
19	8·618	44	19·958	69	31·298	94	42·638
20	9·072	45	20·412	70	31·751	95	43·091
21	9·525	46	20·865	71	32·205	96	43·545
22	9·979	47	21·319	72	32·659	97	43·998
23	10·433	48	21·772	73	33·112	98	44·452
24	10·886	49	22·226	74	33·566	99	44·906
25	11·340	50	22·680	75	34·019	100	45·359

TABLE No. 214.—KILOGRAMMES TO LB.

Kilog.	Lb.	Kilog.	Lb.	Kilog.	Lb.	Kilog.	Lb.
1	2·205	26	57·320	51	112·436	76	167·551
2	4·409	27	59·525	52	114·640	77	169·756
3	6·614	28	61·729	53	116·845	78	171·960
4	8·818	29	63·934	54	119·049	79	174·165
5	11·023	30	66·139	55	121·254	80	176·370
6	13·228	31	68·343	56	123·459	81	178·574
7	15·432	32	70·548	57	125·663	82	180·779
8	17·637	33	72·752	58	127·868	83	182·983
9	19·842	34	74·957	59	130·073	84	185·118
10	22·046	35	77·162	60	132·277	85	187·393
11	24·251	36	79·366	61	134·482	86	189·597
12	26·455	37	81·571	62	136·486	87	191·802
13	28·660	38	83·776	63	138·891	88	194·010
14	30 865	39	85·980	64	141·096	89	196·211
15	33·069	40	88·185	65	143·300	90	198·416
16	35·274	41	90·389	66	145·505	91	200·620
17	37·479	42	92·594	67	147·710	92	202·825
18	39·683	43	94·799	68	149·914	93	205·030
19	41·888	44	97·003	69	152·119	94	207·234
20	44·092	45	99·208	70	154·323	95	209·439
21	46·297	46	101·413	71	156·528	96	211·644
22	48·502	47	103·617	72	158·733	97	213·848
23	50·706	48	105·822	73	160·937	98	216·053
24	52·911	49	108·026	74	163·142	99	218·275
25	55·115	50	110·231	75	165·347	100	220·462

TABLE No. 215.—PRESSURE.

Atmospheres	Lb. per sq. in.	Lb. per sq. ft.	Kilog. per sq. m.	Feet of Water
1	14·7	2116	10333	33·9
2	29·4	4233	20666	67·8
3	44·1	6349	30999	101·7
4	58·8	8465	41332	135·6
5	73·5	10581	51665	169·5
6	88·2	12698	61998	203·4
7	102·9	14814	72331	237·3
8	117·6	16930	82664	271·2
9	132·3	19047	92997	305·1
10	147·0	21163	103330	339·0

TABLE No. 216.

No x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
0	0	0	0·0000	0·0000	∞	0·0	0·000	0·0000
1	1	1	1·0000	1·0000	1·00000	0·1	0·314	0·0079
2	4	8	1·4142	1·2599	0·50000	2	0·628	0·0314
3	9	27	1·7321	1·4422	0·33333	3	0·942	0·0707
4	16	64	2·0000	1·5874	0·25000	4	1·257	0·1257
5	25	125	2·2361	1·7100	0·20000	5	1·571	0·1964
6	36	216	2·4495	1·8171	0·16667	6	1·885	0·2827
7	49	343	2·6458	1·9129	0·14286	7	2·199	0·3848
8	64	512	2·8284	2·0000	0·12500	8	2·513	0·5026
9	81	729	3·0000	2·0801	0·11111	9	2·827	0·6362
10	100	1000	3·1623	2·1544	0·10000	1·0	3·142	0·7854
11	121	1331	3·3166	2·2240	0·09091	1	3·456	0·9503
12	144	1728	3·4641	2·2894	0·08333	2	3·770	1·1310
13	169	2197	3·6056	2·3513	0·07692	3	4·084	1·3273
14	196	2744	3·7417	2·4101	0·07143	4	4·398	1·5394
15	225	3375	3·8730	2·4662	0·06667	5	4·712	1·7671
16	256	4096	4·0000	2·5198	0·06250	6	5·027	2·0106
17	289	4913	4·1231	2·5713	0·05882	7	5·341	2·2698
18	324	5832	4·2426	2·6207	0·05556	8	5·655	2·5447
19	361	6859	4·3589	2·6684	0·05263	9	5·969	2·8353
20	400	8000	4·4721	2·7144	0·05000	2·0	6·283	3·1416
21	441	9261	4·5826	2·7589	0·04762	1	6·597	3·4636
22	484	10648	4·6904	2·8020	0·04545	2	6·912	3·8013
23	529	12167	4·7958	2·8439	0·04348	3	7·226	4·1548
24	576	13824	4·8990	2·8845	0·04167	4	7·540	4·5239
25	625	15625	5·0000	2·9240	0·04000	5	7·854	4·9087
26	676	17576	5·0990	2·9625	0·03846	6	8·168	5·3093
27	729	19683	5·1962	3·0000	0·03704	7	8·482	5·7256
28	784	21952	5·2915	3·0366	0·03571	8	8·796	6·1575
29	841	24389	5·3852	3·0723	0·03448	9	9·111	6·6052
30	900	27000	5·4772	3·1072	0·03333	3·0	9·425	7·0686
31	961	29791	5·5678	3·1414	0·03226	1	9·739	7·5477
32	1024	32768	5·6569	3·1748	0·03125	2	10·05	8·0425
33	1089	35937	5·7446	3·2075	0·03030	3	10·37	8·5530
34	1156	39304	5·8310	3·2396	0·02941	4	10·68	9·0792
35	1225	42875	5·9161	3·2711	0·02857	5	11·00	9·6211
36	1296	46656	6·0000	3·3019	0·02778	6	11·31	10·1790
37	1369	50653	6·0828	3·3322	0·02703	7	11·62	10·752
38	1444	54872	6·1644	3·3620	0·02632	8	11·94	11·341
39	1521	59319	6·2450	3·3912	0·02564	9	12·25	11·946
40	1600	64000	6·3246	3·4200	0·02500	4·0	12·57	12·566

TABLE NO. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
41	1681	68921	6·4031	3·4482	0·02439	4·1	12·88	13·203
42	1764	74088	6·4807	3·4760	0·02381	2	13·19	13·854
43	1849	79507	6·5574	3·5034	0·02326	3	13·51	14·522
44	1936	85184	6·6332	3·5303	0·02273	4	13·82	15·205
45	2025	91125	6·7082	3·5569	0·02222	5	14·14	15·904
46	2116	97336	6·7823	3·5830	0·02174	6	14·45	16·619
47	2209	103823	6·8557	3·6088	0·02128	7	14·77	17·349
48	2304	110592	6·9282	3·6342	0·02083	8	15·08	18·096
49	2401	117649	7·0000	3·6593	0·02041	9	15·39	18·857
50	2500	125000	7·0711	3·6840	0·02000	5·0	15·71	19·635
51	2601	132651	7·1414	3·7084	0·01961	1	16·02	20·428
52	2704	140608	7·2111	3·7325	0·01923	2	16·34	21·237
53	2809	148877	7·2801	3·7563	0·01887	3	16·65	22·062
54	2916	157464	7·3485	3·7798	0·01852	4	16·96	22·902
55	3025	166375	7·4162	3·8030	0·01818	5	17·28	23·758
56	3136	175616	7·4833	3·8259	0·01786	6	17·59	24·630
57	3249	185193	7·5498	3·8485	0·01754	7	17·91	25·518
58	3364	195112	7·6158	3·8709	0·01724	8	18·22	26·421
59	3481	205379	7·6811	3·8930	0·01695	9	18·54	27·340
60	3600	216000	7·7460	3·9149	0·01667	6·0	18·85	28·274
61	3721	226981	7·8102	3·9365	0·01639	1	19·16	29·225
62	3844	238328	7·8740	3·9579	0·01613	2	19·48	30·191
63	3969	250047	7·9373	3·9791	0·01587	3	19·79	31·172
64	4096	262144	8·0000	4·0000	0·01563	4	20·11	32·170
65	4225	274625	8·0623	4·0207	0·01538	5	20·42	33·183
66	4356	287496	8·1240	4·0412	0·01515	6	20·73	34·212
67	4489	300763	8·1854	4·0615	0·01493	7	21·05	35·257
68	4624	314432	8·2462	4·0817	0·01471	8	21·36	36·317
69	4761	328509	8·3066	4·1016	0·01449	9	21·68	37·393
70	4900	343000	8·3666	4·1213	0·01429	7·0	21·99	38·485
71	5041	357911	8·4261	4·1408	0·01408	1	22·31	39·592
72	5184	373248	8·4853	4·1602	0·01389	2	22·62	40·715
73	5329	389017	8·5440	4·1793	0·01370	3	22·93	41·854
74	5476	405224	8·6023	4·1983	0·01351	4	23·25	43·008
75	5625	421875	8·6603	4·2172	0·01333	5	23·56	44·179
76	5776	438976	8·7178	4·2358	0·01316	6	23·88	45·365
77	5929	456533	8·7750	4·2543	0·01299	7	24·19	46·566
78	6084	474552	8·8318	4·2727	0·01282	8	24·50	47·784
79	6241	493039	8·8882	4·2908	0·01266	9	24·82	49·017
80	6400	512000	8·9443	4·3089	0·01250	8·0	25·13	50·265

TABLE No. 216—*contiuued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
81	6561	531441	9·0000	4·3267	0·01235	8·1	25·45	51·530
82	6724	551368	9·0554	4·3445	0·01220	2	25·76	52·810
83	6889	571787	9·1104	4·3621	0·01205	3	26·08	54·106
84	7056	592704	9·1652	4·3795	0·01190	4	26·39	55·418
85	7225	614125	9·2195	4 3968	0·01176	5	26·70	56·745
86	7396	636056	9·2736	4·4140	0·01163	6	27·02	58·088
87	7569	658503	9·3274	4 4310	0·01149	7	27·33	59·447
88	7744	681472	9·3808	4·4480	0·01136	8	27·65	60·821
89	7921	704969	9·4340	4·4647	0·01124	9	27·96	62·211
90	8100	729000	9·4868	4·4814	0·01111	9·0	28·27	63·617
91	8281	753571	9·5394	4·4979	0·01099	1	28·59	65·039
92	8464	778688	9·5917	4·5144	0·01087	2	28·90	66·476
93	8649	804357	9·6437	4·5307	0·01075	3	29·22	67·929
94	8836	830584	9·6954	4·5468	0·01064	4	29·53	69·398
95	9025	857375	9·7468	4·5629	0·01053	5	29·85	70·882
96	9216	884736	9·7980	4·5789	0·01042	6	30·16	72·382
97	9409	912673	9·8489	4·5947	0·01031	7	30·47	73·898
98	9604	941192	9·8995	4·6104	0·01020	8	30·79	75·430
99	9801	970299	9·9499	4·6261	0·01010	9	31·10	76·977
100	10000	1000000	10·0000	4·6416	0·01000	10·0	31·42	78·540
101	10201	1030301	10·0499	4·6570	0·00990	1	31·73	80·118
102	10404	1061208	10·0995	4·6723	0·00980	2	32·04	81·713
103	10609	1092727	10·1489	4·6875	0·00971	3	32·36	83·323
104	10816	1124864	10·1980	4·7027	0·00962	4	32·67	84·949
105	11025	1157625	10·2470	4·7177	0·00952	5	32·99	86·590
106	11236	1191016	10·2956	4·7326	0·00943	6	33·30	88·247
107	11449	1225043	10·3441	4·7475	0·00935	7	33·62	89·920
108	11664	1259712	10·3923	4·7622	0·00926	8	33·93	91·609
109	11881	1295029	10·4403	4·7769	0·00917	9	34·24	93·313
110	12100	1331000	10·4881	4·7914	0·00909	11·0	34·56	95·033
111	12321	1367631	10·5357	4·8059	0·00901	1	34·87	96·769
112	12544	1404928	10·5830	4·8203	0·00893	2	35·19	98·520
113	12769	1442897	10·6301	4·8346	0·00885	3	35·50	100·287
114	12996	1481544	10·6771	4·8488	0·00877	4	35·81	102·070
115	13225	1520875	10·7238	4·8629	0·00870	5	36·13	103·869
116	13456	1560896	10·7703	4·8770	0·00862	6	36·44	105·683
117	13689	1601613	10·8167	4·8910	0·00855	7	36·76	107·513
118	13924	1643032	10·8628	4·9049	0·00847	8	37·07	109·359
119	14161	1685159	10·9087	4·9187	0·00840	9	37·38	111·220
120	14400	1728000	10·9545	4·9324	0·00833	12·0	37·70	113·097

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4} d^2$
121	14641	1771561	11·0000	4·9461	0·00826	12·1	38·01	114·990
122	14884	1815848	11·0454	4·9597	0·00820	2	38·33	116·899
123	15129	1860867	11·0905	4·9732	0·00813	3	38·64	118·823
124	15376	1906624	11·1355	4·9866	0·00806	4	38·96	120·763
125	15625	1953125	11·1803	5·0000	0·00800	5	39·27	122·72
126	15876	2000376	11·2250	5·0133	0·00794	6	39·58	124·69
127	16129	2048383	11·2694	5·0265	0·00787	7	39·90	126·68
128	16384	2097152	11·3137	5·0397	0·00781	8	40·21	128·68
129	16641	2146689	11·3578	5·0528	0·00775	9	40·53	130·70
130	16900	2197000	11·4018	5·0658	0·00769	13·0	40·84	132·73
131	17161	2248091	11·4455	5·0788	0·00763	1	41·15	134·78
132	17424	2299968	11·4891	5·0916	0·00758	2	41·47	136·85
133	17689	2352637	11·5326	5·1045	0·00752	3	41·78	138·93
134	17956	2406104	11·5758	5·1172	0·00746	4	42·10	141·03
135	18225	2460375	11·6190	5·1299	0·00741	5	42·41	143·14
136	18496	2515456	11·6619	5·1426	0·00735	6	42·73	145·27
137	18769	2571353	11·7047	5·1551	0·00730	7	43·04	147·41
138	19044	2628072	11·7473	5·1676	0·00725	8	43·35	149·57
139	19321	2685619	11·7898	5·1801	0·00719	9	43·67	151·75
140	19600	2744000	11·8322	5·1925	0·00714	14·0	43·98	153·94
141	19881	2803221	11·8743	5·2048	0·00709	1	44·30	156·15
142	20164	2863288	11·9164	5·2171	0·00704	2	44·61	158·37
143	20449	2924207	11·9583	5·2293	0·00699	3	44·92	160·61
144	20736	2985984	12·0000	5·2415	0·00694	4	45·24	162·86
145	21025	3048625	12·0416	5·2536	0·00690	5	45·55	165·13
146	21316	3112136	12·0830	5·2656	0·00685	6	45·87	167·42
147	21609	3176523	12·1244	5·2776	0·00680	7	46·18	169·72
148	21904	3241792	12·1655	5·2896	0·00676	8	46·50	172·03
149	22201	3307949	12·2066	5·3015	0·00671	9	46·81	174·37
150	22500	3375000	12·2474	5·3133	0·00667	15·0	47·12	176·71
151	22801	3442951	12·2882	5·3251	0·00662	1	47·44	179·08
152	23104	3511808	12·3288	5·3368	0·00658	2	47·75	181·46
153	23409	3581577	12·3693	5·3485	0·00654	3	48·07	183·85
154	23716	3652264	12·4097	5·3601	0·00649	4	48·38	186·27
155	24025	3723875	12·4499	5·3717	0·00645	5	48·69	188·69
156	24336	3796416	12·4900	5·3832	0·00641	6	49·01	191·13
157	24649	3869893	12·5300	5·3947	0·00637	7	49·32	193·59
158	24964	3944312	12·5698	5·4061	0·00633	8	49·64	196·07
159	25281	4019679	12·6095	5·4175	0·00629	9	49·95	198·56
160	25600	4096000	12·6491	5·4288	0·00625	16·0	50·27	201·06

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
161	25921	4173281	12·6886	5·4401	0·00621	16·1	50·58	203·58
162	26244	4251528	12·7279	5·4514	0·00617	2	50·89	206·12
163	26569	4330747	12·7671	5·4626	0·00613	3	51·21	208·67
164	26896	4410944	12·8062	5·4737	0·00610	4	51·52	211·24
165	27225	4492125	12·8452	5·4848	0·00606	5	51·84	213·82
166	27556	4574296	12·8841	5·4959	0·00602	6	52·15	216·42
167	27889	4657463	12·9228	5·5069	0·00599	7	52·46	219·04
168	28224	4741632	12·9615	5·5178	0·00595	8	52·78	221·67
169	28561	4826809	13·0000	5·5288	0·00592	9	53·09	224·32
170	28900	4913000	13·0384	5·5397	0·00588	17·0	53·41	226·98
171	29241	5000211	13·0767	5·5505	0·00585	1	53·72	229·66
172	29584	5088448	13·1149	5·5613	0·00581	2	54·04	232·35
173	29929	5177717	13·1529	5·5721	0·00578	3	54·35	235·06
174	30276	5268024	13·1909	5·5828	0·00575	4	54·66	237·79
175	30625	5359375	13·2288	5·5934	0·00571	5	54·98	240·53
176	30976	5451776	13·2665	5·6041	0·00568	6	55·29	243·28
177	31329	5545233	13·3341	5·6147	0·00565	7	55·61	246·06
178	31684	5639752	13·3417	5·6252	0·00562	8	55·92	248·85
179	32041	5735339	13·3791	5·6357	0·00559	9	56·23	251·65
180	32400	5832000	13·4164	5·6462	0·00556	18·0	56·55	254·47
181	32761	5929741	13·4536	5·6567	0·00552	1	56·86	257·30
182	33124	6028568	13·4907	5·6671	0·00549	2	57·18	260·16
183	33489	6128487	13·5277	5·6774	0·00546	3	57·49	263·02
184	33856	6229504	13·5647	5·6877	0·00543	4	57·81	265·90
185	34225	6331625	13·6015	5·6980	0·00541	5	58·12	268·80
186	34596	6434856	13·6382	5·7083	0·00538	6	58·43	271·72
187	34969	6539203	13·6748	5·7185	0·00535	7	58·75	274·65
188	35344	6644672	13·7113	5·7287	0·00532	8	59·06	277·59
189	35721	6751269	13·7477	5·7388	0·00529	9	59·38	280·55
190	36100	6859000	13·7840	5·7489	0·00526	19·0	59·69	283·53
191	36481	6967871	13·8203	5·7590	0·00524	1	60·00	286·52
192	36864	7077888	13·8564	5·7690	0·00521	2	60·32	289·53
193	37249	7189057	13·8924	5·7790	0·00518	3	60·63	292·55
194	37636	7301384	13·9284	5·7890	0·00515	4	60·95	295·59
195	38025	7414875	13·9642	5·7989	0·00513	5	61·26	298·65
196	38416	7529536	14·0000	5·8088	0·00510	6	61·58	301·72
197	38809	7645373	14·0357	5·8186	9·00508	7	61·89	304·81
198	39204	7762392	14·0712	5·8285	0·00505	8	62·20	307·91
199	39601	7880599	14·1067	5·8383	0·00503	9	62·52	311·03
200	40000	8000000	14·1421	5·8480	0·00500	20·0	62·83	314·16

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
201	40401	8120601	14·1774	5·8578	0·00498	20·1	63·15	317·31
202	40804	8242408	14·2127	5·8675	0·00495	2	63·46	320·47
203	41209	8365427	14·2478	5·8771	0·00493	3	63·77	323·65
204	41616	8489664	14·2829	5·8868	0·00490	4	64·09	326·85
205	42025	8615125	14·3178	5·8964	0·00488	5	64·40	330·06
206	42436	8741816	14·3527	5·9059	0·00485	6	64·72	333·29
207	42849	8869743	14·3875	5·9155	0·00483	7	65·03	336·54
208	43264	8998912	14·4223	5·9250	0·00481	8	65·35	339·79
209	43681	9129323	14·4568	5·9345	0·00478	9	65·66	343·07
210	44100	9261000	14·4914	5·9439	0·00476	21·0	65·97	346·36
211	44521	9393931	14·5258	5·9533	0·00474	1	66·29	349·67
212	44944	9528128	14·5602	5·9627	0·00472	2	66·60	352·99
213	45369	9663597	14·5945	5·9721	0·00469	3	66·92	356·33
214	45796	9800344	14·6287	5·9814	0·00467	4	67·23	359·68
215	46225	9938375	14·6629	5·9907	0·00465	5	67·54	363·05
216	46656	10077696	14·6969	6·0000	0·00463	6	67·86	366·44
217	47089	10218313	14·7309	6·0092	0·00461	7	68·17	369·84
218	47524	10360232	14·7648	6·0185	0·00459	8	68·49	373·25
219	47961	10503459	14·7986	6·0277	0·00457	9	68·80	376·68
220	48400	10648000	14·8324	6·0368	0·00455	22·0	69·12	380·13
221	48841	10793861	14·8661	6·0459	0·00452	1	69·43	383·60
222	49284	10941048	14·8997	6·0550	0·00450	2	69·74	387·08
223	49729	11089567	14·9332	6·0641	0·00448	3	70·06	390·57
224	50176	11239424	14·9666	6·0732	0·00446	4	70·37	394·08
225	50625	11390625	15·0000	6·0822	0·00444	5	70·69	397·61
226	51076	11543176	15·0333	6·0912	0·00442	6	71·00	401·15
227	51529	11697083	15·0665	6·1002	0·00441	7	71·31	404·71
228	51984	11852352	15·0997	6·1091	0·00439	8	71·63	408·28
229	52441	12008989	15·1327	6·1180	0·00437	9	71·94	411·87
230	52900	12167000	15·1658	6·1269	0·00435	23·0	72·26	415·48
231	53361	12326391	15·1987	6·1358	0·00433	1	72·57	419·10
232	53824	12487168	15·2315	6·1446	0·00431	2	72·88	422·73
233	54289	12649337	15·2643	6·1534	0·00429	3	73·20	426·38
234	54756	12812904	15·2971	6·1622	0·00427	4	73·51	430·05
235	55225	12977875	15·3297	6·1710	0·00426	5	73·83	433·74
236	55696	13144256	15·3623	6·1797	0·00424	6	74·14	437·44
237	56169	13312053	15·3948	6·1885	0·00422	7	74·46	441·15
238	56644	13481272	15·4272	6·1972	0·00420	8	74·77	444·88
239	57121	13651919	15·4596	6·2058	0·00418	9	75·08	448·63
240	57600	13824000	15·4919	6·2145	0·00417	24·0	75·40	452·39

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
241	58081	13997521	15·5242	6·2231	0·00415	24·1	75·71	456·17
242	58564	14172488	15·5563	6·2317	0·00413	2	76·03	459·96
243	59049	14348907	15·5885	6·2403	0·00412	3	76·34	463·77
244	59536	14526784	15·6205	6·2488	0·00410	4	76·65	467·59
245	60025	14706125	15·6525	6·2573	0·00408	5	76·97	471·44
246	60516	14886936	15·6844	6·2658	0·00407	6	77·28	475·29
247	61009	15069223	15·7162	6·2743	0·00405	7	77·60	479·16
248	61504	15252992	15·7480	6·2828	0·00403	8	77·91	483·05
249	62001	15438249	15·7797	6·2912	0·00402	9	78·23	486·95
250	62500	15625000	15·8114	6·2996	0·00400	25·0	78·54	490·87
251	63001	15813251	15·8430	6·3080	0·00398	1	78·85	494·81
252	63504	16003008	15·8745	6·3164	0·00397	2	79·17	498·76
253	64009	16194277	15·9060	6·3247	0·00395	3	79·48	502·73
254	64516	16387064	15·9374	6·3330	0·00394	4	79·80	506·71
255	65025	16581375	15·9687	6·3413	0·00392	5	80·11	510·71
256	65536	16777216	16·0000	6·3496	0·00391	6	80·42	514·72
257	66049	16974593	16·0312	6·3579	0·00389	7	80·74	518·75
258	66564	17173512	16·0624	6·3661	0·00388	8	81·05	522·79
259	67081	17373979	16·0935	6·3743	0·00386	9	81·37	526·85
260	67600	17576000	16·1245	6·3825	0·00385	26·0	81·68	530·93
261	68121	17779581	16·1555	6·3907	0·00383	1	82·00	535·02
262	68644	17984728	16·1864	6·3988	0·00382	2	82·31	539·13
263	69169	18191447	16·2173	6·4070	0·00380	3	82·62	543·25
264	69696	18399744	16·2481	6·4151	0·00379	4	82·94	547·39
265	70225	18609625	16·2788	6·4232	0·00377	5	83·25	551·55
266	70756	18821096	16·3095	6·4312	0·00376	6	83·57	555·72
267	71289	19034163	16·3401	6·4393	0·00375	7	83·88	559·90
268	71824	19248832	16·3707	6·4473	0·00373	8	84·19	564·10
269	72361	19465109	16·4012	6·4553	0·00372	9	84·51	568·32
270	72900	19683000	16·4317	6·4633	0·00370	27·0	84·82	572·56
271	73441	19902511	16·4621	6·4713	0·00369	1	85·14	576·80
272	73984	20123648	16·4924	6·4792	0·00368	2	85·45	581·07
273	74529	20346417	16·5227	6·4872	0·00366	3	85·77	585·35
274	75076	20570824	16·5529	6·4951	0·00365	4	86·08	589·65
275	75625	20796875	16·5831	6·5030	0·00364	5	80·39	593·96
276	76176	21024576	16·6132	6·5108	0·00362	6	86·71	598·28
277	76729	21253933	16·6433	6·5187	0·00361	7	87·02	602·63
278	77284	21484952	16·6733	6·5265	0·00360	8	87·34	606·99
279	77841	21717639	16·7033	6·5343	0·00358	9	87·65	611·36
280	78400	21952000	16·7332	6·5421	0·00357	28·0	87·96	615·75

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^2	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4} d^2$
281	78961	22188041	16·7631	6·5499	0·00356	28·1	88·28	620·16
282	79524	22425768	16·7929	6·5577	0·00355	2	88·59	624·58
283	80089	22665187	16·8226	6·5654	0·00353	3	88·91	629·02
284	80656	22906304	16·8523	6·5731	0·00352	4	89·22	633·47
285	81225	23149125	16·8819	6·5808	0·00351	5	89·54	637·94
286	81796	23393656	16·9115	6·5885	0·00350	6	89·85	642·42
287	82369	23639903	16·9411	6·5962	0·00348	7	90·16	646·92
288	82944	23887872	16·9706	6·6039	0·00347	8	90·48	651·44
289	83521	24137569	17·0000	6·6115	0·00346	9	90·79	655·97
290	84100	24389000	17·0294	6·6191	0·00345	29·0	91·11	660·52
291	84681	24642171	17·0587	6·6267	0·00344	1	91·42	665·08
292	85264	24897088	17·0880	6·6343	0·00342	2	91·73	669·66
293	85849	25153757	17·1172	6·6419	0·00341	3	92·05	674·26
294	86436	25412184	17·1464	6·6492	0·00340	4	92·36	678·87
295	87025	25672375	17·1756	6·6569	0·00339	6	92·68	683·49
296	87616	25934336	17·2047	6·6644	0·00338	6	92·99	688·13
297	88209	26198073	17·2337	6·6719	0·00337	7	93·31	692·79
298	88804	26463592	17·2627	6·6794	0·00336	8	93·62	697·46
299	89401	26730899	17·2916	6·6869	0·00334	9	93·93	702·15
300	90000	27000000	17·3205	6·6943	0·00333	30·0	94·25	706·86
301	90601	27270901	17·3494	6·7018	0·00332	1	94·56	711·58
302	91204	27543608	17·3781	6·7092	0·00331	2	94·88	716·31
303	91809	27818127	17·4069	6·7166	0·00320	3	95·19	721·07
304	92416	28094464	17·4356	6·7240	0·00329	4	95·50	725·83
305	93025	28372625	17·4642	6·7313	0·00328	5	95·82	730·62
306	93636	28652616	17·4929	6·7387	0·00327	6	96·13	735·42
307	94249	28934443	17·5214	6·7460	0·00326	7	96·45	740·23
308	94864	29218112	17·5499	6·7533	0·00325	8	96·76	745·06
309	95481	29503629	17·5784	6·7606	0·00324	9	97·08	749·91
310	96100	29791000	17·6068	6·7679	0·00323	31·0	97·39	754·77
311	96721	30080231	17·6352	6·7752	0·00322	1	97·70	759·64
312	97344	30371328	17·6635	6·7824	0·00321	2	98·02	764·54
313	97969	30664297	17·6918	6·7897	0·00319	3	98·33	769·44
314	98596	30959144	17·7200	6·7969	0·00318	4	98·65	774·37
315	99225	31255875	17·7482	6·8041	0·00317	5	98·96	779·31
316	99856	31554496	17·7764	6·8113	0·00316	6	99·27	784·27
317	100489	31855013	17·8045	6·8185	0·00315	7	99·59	789·24
318	101124	32157432	17·8326	6·8256	0·00314	8	99·90	794·23
319	101761	32461759	17·8606	6·8328	0·00313	9	100·2	799·23
320	102400	32768000	17·8885	6·8399	0·00313	32·0	100·5	804·25

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
321	103041	33076161	17·9165	6·8470	0·00312	32·1	100·8	809·28
322	103684	33386248	17·9444	6·8541	0·00311	2	101·2	814·33
323	104329	33698267	17·9722	6·8612	0·00310	3	101·5	819·40
324	104976	34012224	18·0000	6·8683	0·00309	4	101·8	824·48
325	105625	34328124	18·0278	6·8753	0·00308	5	102·1	829·58
326	106276	34645976	18·0555	6·8824	0·00307	6	102·4	834·69
327	106929	34965783	18·0831	6·8894	0·00306	7	102·7	839·82
328	107584	35287552	18·1108	6·8964	0·00305	8	103·0	844·96
329	108241	35611289	18·1384	6·9034	0·00304	9	103·4	850·12
330	108900	35937000	18·1659	6·9104	0·00303	33·0	103·7	855·30
331	109561	36264691	18·1934	6·9174	0·00302	1	104·0	860·49
332	110224	36594368	18·2209	6·9244	0·00301	2	104·3	865·70
333	110889	36926037	18·2483	6·9313	0·00300	3	104·6	870·92
334	111556	37259704	18·2757	6·9382	0·00299	4	104·9	876·16
335	112225	37595375	18·3030	6·9451	0·00299	5	105·2	881·41
336	112896	37933056	18·3303	6·9521	0·00298	6	105·6	886·68
337	113569	38272753	18·3576	6·9589	0·00297	7	105·9	891·97
338	114244	38614472	18·3848	6·9658	0·00296	8	106·2	897·27
339	114921	38958219	18·4120	6·9727	0·00295	9	106·5	902·59
340	115600	39304000	18·4391	6·9795	0·00294	34·0	106·8	907·92
341	116281	39651821	18·4662	6·9864	0·00293	1	107·1	913·27
342	116964	40001688	18·4932	6·9932	0·00292	2	107·4	918·63
343	117649	40353607	18·5203	7·0000	0·00292	3	107·8	924·01
344	118336	40707584	18·5472	7·0068	0·00291	4	108·1	929·41
345	119025	41063625	18·5742	7·0136	0·00290	5	108·4	934·82
346	119716	41421736	18·6011	7·0203	0·00289	6	108·7	940·25
347	120409	41781923	18·6279	7·0271	0·00288	7	109·0	945·69
348	121104	42144192	18·6548	7·0338	0·00287	8	109·3	951·15
349	121801	42508549	18·6815	7·0406	0·00287	9	109·6	956·62
350	122500	42875000	18·7083	7·0473	0·00286	35·0	110·0	962·11
351	123201	43243551	18·7350	7·0540	0·00285	1	110·3	967·62
352	123904	43614208	18·7617	7·0607	0·00284	2	110·6	973·14
353	124609	43986977	18·7883	7·0674	0·00283	3	110·9	978·68
354	125316	44361864	18·8149	7·0740	0·00282	4	111·2	984·23
355	126025	44738875	18·8414	7·0807	0·00282	5	111·5	989·80
356	126736	45118016	18·8680	7·0873	0·00281	6	111·8	995·38
357	127449	45499293	18·8944	7·0940	0·00280	7	112·2	1001·0
358	128164	45882712	18·9209	7·1006	0·00279	8	112·5	1006·6
359	128881	46268279	18·9473	7·1072	0·00279	9	112·8	1012·2
360	129600	46656000	18·9737	7·1138	0·00278	36·0	113·1	1017·9

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
361	130321	47045881	19·0000	7·1204	0·00277	36·1	113·4	1023·5
362	131044	47437928	19·0263	7·1269	0·00276	2	113·7	1029·2
363	131769	47832147	19·0526	7·1335	0·00275	3	114·0	1034·9
364	132496	48228544	19·0788	7·1400	0·00275	4	114·4	1040·6
365	133225	48627125	19·1050	7·1466	0·00274	5	114·7	1046·3
366	133956	49027896	19·1311	7·1531	0·00273	6	115·0	1052·1
367	134689	49430863	19·1572	7·1596	0·00272	7	115·3	1057·8
368	135424	49836032	19·1833	7·1661	0·00272	8	115·6	1063·6
369	136161	50243409	19·2094	7·1726	0·00271	9	115·9	1069·4
370	136900	50653000	19·2354	7·1791	0·00270	37·0	116·2	1075·2
371	137641	51064811	19·2614	7·1855	0·00270	1	116·6	1081·0
372	138384	51478848	19·2873	7·1920	0·00269	2	116·9	1086·9
373	139129	51895117	19·3132	7·1984	0·00268	3	117·2	1092·7
374	139876	52313624	19·3391	7·2048	0·00267	4	117·6	1098·6
375	140625	52734375	19·3649	7·2112	0·00267	5	117·8	1104·5
376	141376	53157376	19·3907	7·2177	0·00266	6	118·1	1110·4
377	142129	53582633	19·4165	7·2240	0·00265	7	118·4	1116·3
378	142884	54010152	19·4422	7·2304	0·00265	8	118·8	1122·2
379	143641	54439939	19·4679	7·2368	0·00264	9	119·1	1128·1
380	144400	54872000	19·4936	7·2432	0·00263	38·0	119·4	1134·1
381	145161	55306341	19·5192	7·2495	0·00262	1	119·7	1140·1
382	145924	55742968	19·5448	7·2558	0·00262	2	120·0	1146·1
383	146689	56181887	19·5704	7·2622	0·00261	3	120·3	1152·1
384	147456	56623104	19·5959	7·2685	0·00260	4	120·6	1158·1
385	148225	57066625	19·6214	7·2748	0·00260	5	121·0	1164·2
386	148996	57512456	19·6469	7·2811	0·00259	6	121·3	1170·2
387	149769	57960603	19·6723	7·2874	0·00258	7	121·6	1176·3
388	150544	58411072	19·6977	7·2936	0·00258	8	121·9	1182·4
389	151321	58863869	19·7231	7·2999	0·00257	9	122·2	1188·5
390	152100	59319000	19·7484	7·3061	0·00256	~~38~~·0 39	122·5	1194·6
391	152881	59776471	19·7737	7·3124	0·00256	1	122·8	1200·7
392	153664	60236288	19·7990	7·3186	0·00255	2	123·2	1206·9
393	154449	60698457	19·8242	7·3248	0·00254	3	123·5	1213·0
394	155236	61162984	19·8494	7·3310	0·00254	4	123·8	1219·2
395	156025	61629875	19·8746	7·3372	0·00253	5	124·1	1225·4
396	156816	62099136	19·8997	7·3434	0·00253	6	124·4	1231·1
397	157609	62570773	19·9249	7·3496	0·00252	7	124·7	1237·9
398	158404	63044792	19·9499	7·3558	0·00251	8	125·0	1244·1
398	159201	63521199	19·9750	7·3619	0·00251	9	125·3	1250·4
400	160000	64000000	20·0000	7·3681	0·00250	40·0	125·7	1256·6

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
401	160801	64481201	20·0250	7·3742	0·00249	40·1	126·0	1262·9
402	161604	64964808	20·0499	7·3803	0·00249	2	126·3	1269·2
403	162409	65450827	20·0749	7·3864	0·00248	3	126·6	1275·6
404	163216	65939264	20·0998	7·3925	0·00248	4	126·9	1281·9
405	164025	66430125	20·1246	7·3986	0·00247	5	127·2	1288·2
406	164836	66923416	20·1494	7·4047	0·00246	6	127·5	1294·6
407	165649	67419143	20·1742	7·4108	0·00246	7	127·9	1301·0
408	166464	67917312	20·1990	7·4169	0·00245	3	128·2	1307·4
409	167281	68417929	20·2237	7·4229	0·00244	9	128·5	1313·8
410	168100	68921000	20·2485	7·4290	0·00244	41·0	128·8	1320·3
411	168921	69426531	20·2731	7·4350	0·00243	1	129·1	1326·7
412	169744	69934528	20·2978	7·4410	0·00243	2	129·4	1333·2
413	170569	70444997	20·3224	7·4470	0·00242	3	129·7	1339·6
414	171396	70957944	20·3470	7·4530	0·00242	4	130·1	1346·1
415	172225	71473375	20·3715	7·4590	0·00241	5	130·4	1352·7
416	173056	71991296	20·3961	7·4650	0·00240	6	130·7	1359·2
417	173889	72511713	20·4206	7·4710	0·00240	7	131·0	1365·7
418	174724	73034632	20·4450	7·4770	0·00239	8	131·3	1372·3
419	175561	73560059	20·4695	7·4829	0·00239	9	131·6	1378·9
420	176400	74088000	20·4939	7·4889	0·00238	42·0	131·9	1385·4
421	177241	74618461	20·5183	7·4948	0·00238	1	132·3	1392·0
422	178084	75151448	20·5426	7·5007	0·00237	2	132·6	1398·7
423	178929	75686967	20·5670	7·5067	0·00236	3	132·9	1405·3
424	179776	76225024	20·5913	7·5126	0·00236	4	133·2	1412·0
425	180625	76765625	20·6155	7·5185	0·00235	5	133·5	1418·6
426	181476	77308776	20·6398	7·5244	0·00235	6	133·8	1425·3
427	182329	77854483	20·6640	7·5302	0·00234	7	134·1	1432·0
428	183184	78402752	20·6882	7·5361	0·00234	8	134·5	1438·7
429	184041	78953589	20·7123	7·5420	0·00233	9	134·8	1445·5
430	184900	79507000	20·7364	7·5478	0·00233	43·0	135·1	1452·2
431	185761	80062991	20·7605	7·5537	0·00232	1	135·4	1459·0
432	186624	80621568	20·7846	7·5595	0·00231	2	135·7	1465·7
433	187489	81182737	20·8087	7·5654	0·00231	3	136·0	1472·5
434	188356	81746504	20·8327	7·5712	0·00230	4	136·3	1479·3
435	189225	82312875	20·8567	7·5770	0·00230	5	136·7	1486·2
436	190096	82881856	20·8806	7·5828	0·00229	6	137·0	1493·0
437	190969	83453453	20·9045	7·5886	0·00229	7	137·3	1499·9
438	191844	84027672	20·9284	7·5844	0·00228	8	137·6	1506·7
439	193721	84604519	20·9523	7·6001	0·00228	9	137·9	1513·6
440	193600	85184000	20·9762	7·6059	0·00227	44·0	138·2	1520·5

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
441	194481	85766121	21·0000	7·6117	0·00227	44·1	138·5	1527·5
442	195364	86350888	21·0238	7·6174	0·00226	2	138·9	1534·4
443	196249	86938307	21·0476	7·6232	0·00226	3	139·2	1541·3
444	197136	87528384	21·0713	7·6289	0·00225	4	139·5	1548·3
445	198025	88121125	21·0950	7·6346	0·00225	5	139·8	1555·3
446	198916	88716536	21·1187	7·6403	0·00224	6	140·1	1562·3
447	199809	89314623	21·1424	7·6460	0·00224	7	140·4	1569·3
448	200704	89915392	21·1660	7·6517	0·00223	8	140·7	1576·3
449	201601	90518849	21·1896	7·6574	0·00223	9	141·1	1583·4
450	202500	91125000	21·2132	7·6631	0·00222	45·0	141·4	1590·4
451	203401	91733851	21·2368	7·6688	0·00222	1	141·7	1597·5
452	204304	92345408	21·2603	7·6744	0·00221	2	142·0	1604·6
453	205209	92959677	21·2838	7·6801	0·00221	3	142·3	1611·7
454	206116	93576664	21·3073	7·6857	0·00220	4	142·6	1618·8
455	207025	94196375	21·3307	7·6914	0.00220	5	142·9	1626·0
456	207936	94818816	21·3542	7·6970	0·00219	6	143·3	1633·1
457	208849	95443993	21·3776	7·7026	0·00219	7	143·6	1640·3
458	209764	96071912	21·4009	7·7082	0·00218	8	143·9	1647·5
459	210681	96702579	21·4243	7·7138	0·00218	9	144·2	1654·7
460	211600	97336000	21·4476	7·7194	0·00217	46·0	144·5	1661·9
461	212521	97972181	21·4709	7·7250	0·00217	1	144·8	1669·1
462	213444	98611128	21·4942	7·7306	0·00216	2	145·1	1676·4
463	214369	99252847	21·5174	7·7362	0·00216	3	145·5	1683·7
464	215296	99897344	21·5407	7·7418	0·00216	4	145·8	1690·9
465	216225	100544625	21·5639	7·7473	0·00215	5	146·1	1698·2
466	217156	101194696	21·5870	7·7529	0·00215	6	146·4	1705·5
467	218089	101847563	21·6102	7·7584	0·00214	7	146·7	1712·9
468	219024	102503232	21·6333	7·7639	0·00214	8	147·0	1720·2
469	219961	103161709	21·6564	7·7695	0·00213	9	147·3	1727·6
470	220900	103823000	21·6795	7·7750	0·00213	47·0	147·7	1734·9
471	221841	104487111	21·7025	7·7805	0·00212	1	148·0	1742·3
472	222784	105154048	21·7256	7·7860	0·00212	2	148·3	1749·7
473	223729	105823817	21·7486	7·7915	0·00211	3	148·6	1757·2
474	224676	106496424	21·7715	7·7970	0·00211	4	148·9	1764·6
475	225625	107171875	21·7945	7·8025	0·00211	5	149·2	1772·1
476	226576	107850176	21·8174	7·8079	0·00210	6	149·5	1779·5
477	227529	108531333	21·8403	7·8134	0·00210	7	149·9	1787·0
478	228484	109215352	21·8632	7·8188	0·00209	8	150·2	1794·5
479	229441	109902239	21·8861	7·8243	0·00209	9	150·5	1802·0
480	230400	110592000	21·9089	7·8297	0·00208	48·0	150·8	1809·6

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
481	231361	111284641	21·9317	7·8352	0·00208	48·1	151·1	1817·1
482	232324	111980168	21·9545	7·8406	0·00207	2	151·4	1824·7
483	233289	112678587	21·9773	7·8460	0·00207	3	151·7	1832·2
484	234256	113379904	22·0000	7·8514	0·00207	4	152·1	1839·8
485	235225	114084125	22·0227	7·8568	0·00206	5	152·4	1847·5
486	236196	114791256	22·0454	7·8622	0·00206	6	152·7	1855·1
487	237169	115501303	22·0681	7·8676	0·00205	7	153·0	1862·7
488	238144	116214272	22·0907	7·8730	0·00205	8	153·3	1870·4
489	239121	116930169	22·1133	7·8784	0·00204	9	153·6	1878·1
490	240100	117649000	22·1359	7·8837	0·00204	49·0	153·9	1885·7
491	241081	118370771	22·1585	7·8891	0·00204	1	154·3	1893·4
492	242064	119095488	22·1811	7·8944	0·00203	2	154·6	1901·2
493	243049	119823157	22·2036	7·8998	0·00203	2	154·9	1908·9
494	244036	120553784	22·2261	7·9051	0·00202	4	155·2	1916·7
495	245025	121287375	22·2486	7·9105	0·00202	5	155·5	1924·4
496	246016	122023936	22·2711	7·9158	0·00202	6	155·8	1932·2
497	247009	122763473	22·2935	7·9211	0·00201	7	156·1	1940·0
498	248004	123505992	22·3159	7·9264	0·00201	8	156·5	1947·8
499	249001	124251499	22·3383	7·9317	0·00200	9	156·8	1955·6
500	250000	125000000	22·3607	7·9370	0·00200	50·0	157·1	1963·5
501	251001	125751501	22·3830	7·9423	0·00200	1	157·4	1971·4
502	252004	126506008	22·4054	7·9476	0·00199	2	157·7	1979·2
503	253009	127263527	22·4277	7·9528	0·00199	3	158·0	1987·1
504	254016	128024064	22·4499	7·9581	0·00198	4	158·3	1995·0
505	255025	128787625	22·4722	7·9634	0·00198	5	158·7	2003·0
506	256036	129554216	22·4944	7·9686	0·00198	6	159·0	2010·9
507	257049	130323843	22·5167	7·9739	0·00197	7	159·3	2018·9
508	258064	131096512	22·5389	4·9791	0·00197	8	159·6	2026·8
509	259081	131872229	22·5610	7·9843	0·00196	9	159·9	2034·8
510	260100	132651000	22·5832	7·9896	0·00196	51·0	160·2	2042·8
511	261121	133432831	22·6053	7·9948	0·00196	1	160·5	2050·8
512	262144	134217728	22·6274	8·0000	0·00195	2	160·8	2058·9
513	263169	135005697	22·6495	8·0052	0·00195	3	161·2	2066·9
514	264196	135796744	22·6716	8·0104	0·00195	4	161·5	2075·0
515	265225	136590875	22·6936	8·0156	0·00194	5	161·8	2083·1
516	266256	137388096	22·7156	8·0208	0·00194	6	162·1	2091·2
517	267289	138188413	22·7376	8·0260	0·00193	7	162·4	2099·3
518	268324	138991832	22·7596	8·0311	0·00193	2	162·7	2107·4
519	269361	139798359	22·7816	8·0363	0·00193	9	163·0	2115·6
520	270400	140608000	22·8035	8·0415	0·00192	52·0	163·4	2123·7

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
521	271441	141420761	22·8254	8·0466	0·00192	52·1	163·7	2131·9
522	272484	142236648	22·8473	8·0517	0·00192	2	164·0	2140·1
523	273529	143055667	22·8692	8·0569	0·00191	3	164·3	2148·3
524	274576	143877824	22·8910	8·0620	0·00191	4	164·6	2156·5
525	275625	144703125	22·9129	8·0671	0·00190	5	164·9	2164·8
526	276676	145531576	22·9347	8·0723	0·00190	6	165·2	2173·0
527	277729	146363183	22·9565	8·0774	0·00190	7	165·6	2181·3
528	278784	147197952	22·9783	8·0825	0·00189	8	165·9	2189·6
529	279841	148035889	23·0000	8·0876	0·00189	9	166·2	2197·9
530	280900	148877000	23·0217	8·0927	0·00189	53·0	166·5	2206·2
531	281961	149721291	23·0434	8·0978	0·00188	1	166·8	2214·5
532	283024	150568768	23·0651	8·1028	0·00188	2	167·1	2222·9
533	284089	151419437	23·0868	8·1079	0·00188	3	167·4	2231·2
534	285156	152273304	23·1084	8·1130	0·00187	4	167·8	2239·6
535	286225	153130375	23·1301	8·1180	0·00187	5	168·1	2248·0
536	287296	153990656	23·1517	8·1231	0·00187	6	168·4	2256·4
537	288369	154854153	23·1733	8·1281	0·00186	7	168·7	2264·8
538	289444	155720872	23·1948	8·1332	0·00186	8	169·0	2273·3
539	290521	156590819	23·2164	8·1382	0·00186	9	169·3	2281·7
540	291600	157464000	23·2379	8·1433	0·00185	54·0	169·6	2290·2
541	292681	158340421	23·2594	3·1483	0·00185	1	170·0	2298·7
542	293764	159220088	23·2809	8·1533	0·00185	2	170·3	2307·2
543	294849	160103007	23·3024	8·1583	0·00184	3	170·6	2315·7
544	295936	160989184	23·3238	8·1633	0·00184	4	170·9	2324·3
545	297025	161878625	23·3452	8·1683	0·00183	5	171·2	2332·8
546	298116	162771336	23·3666	8·1733	0·00183	6	171·5	2341·4
547	299209	163667323	23·3880	8·1783	0·00183	7	171·8	2350·0
548	300304	164566592	23·4094	8·1833	0·00182	8	172·2	2358·6
549	301401	165469149	23·4307	8·1882	0·00182	9	172·5	2367·2
550	302500	166375000	23·4521	8·1932	0·00182	55·0	172·8	2375·8
551	303601	167284151	23·4734	8·1982	0·00181	1	173·1	2384·5
552	304704	168196608	23·4947	8·2031	0·00181	2	173·4	2393·1
553	305809	169112377	23·5160	8·2081	0·00181	3	173·7	2401·8
554	306916	170031464	23·5372	8·2130	0·00181	4	174·0	2410·5
555	308025	170953875	23·5584	8·2180	0·00180	5	174·4	2419·2
556	309136	171879616	23·5797	8·2229	0·00180	6	174·7	2427·9
557	310249	172808693	23·6008	8·2278	0·00180	7	175·0	2436·7
558	311364	173741112	23·6220	8·2327	0·00179	8	175·3	2445·4
559	312481	174676879	23·6432	8·2377	0·00179	9	175·6	2454·2
560	313600	175616000	23·6643	8·2426	0·00179	56·0	175·9	2463·0

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d.	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
561	314721	176558481	23·6854	8·2475	0·00178	56·1	176·2	2471·8
562	315844	177504328	23·7065	8·2524	0·00178	2	176·6	2480·6
563	316969	178453547	23·7276	8·2573	0·00178	3	176·9	2489·5
564	318096	179406144	23·7487	8·2621	0·00177	4	177·2	2498·3
565	319225	180362126	23·7697	8·2670	0·00177	5	177·5	2507·2
566	320356	181321495	23·7908	8·2719	0·00177	6	177·8	2516·1
567	321489	182284263	23·8118	8·2768	0·00176	7	178·1	2525·0
568	322624	183250432	23·8328	8·2816	0·00176	8	178·4	2533·9
569	323761	184220009	23·8537	8·2865	0·00176	9	178·8	2542·8
570	324900	185193000	23·8747	8·2913	0·00175	57·0	179·1	2551·8
571	326041	186169411	23·8956	8·2962	0·00175	1	179·4	2560·7
572	327184	187149248	23·9165	8·3010	0·00175	2	179·7	2569·7
573	328329	188132517	23·9374	8·3059	0·00175	3	180·0	2578·7
574	329476	189119224	23·9583	8·3107	0·00174	4	180·3	2587·7
575	330625	190109375	23·9792	8·3155	0·00174	5	180·6	2596·7
576	331776	191102976	24·0000	8·3203	0·00174	6	181·0	2605·8
577	332929	192100033	24·0208	8·3251	0·00173	7	181·3	2614·8
578	334084	193100552	24·0416	8·3300	0·00173	8	181·6	2623·9
579	335241	194104539	24·0624	8·3348	0·00173	9	181·9	2633·0
580	336400	195112000	24·0832	8·3396	0·00172	58·0	182·2	2642·1
581	337561	196122941	24·1039	8·3443	0·00172	1	182·5	2651·2
582	338724	197137368	24·1247	8·3491	0·00172	2	182·8	2660·3
583	339889	198155287	24·1554	8·3539	0·00172	3	183·2	2669·5
584	341056	199176704	24·1661	8·3587	0·00171	4	183·5	2678·6
585	342225	200201625	24·1868	8·3634	0·00171	5	183·8	2687·8
586	343396	201230056	24·2074	8·3682	0·00171	6	184·1	2697·0
587	344569	202262003	24·2281	8·3730	0·00170	7	184·4	2706·2
588	345744	203297472	24·2487	8·3777	0·00170	8	184·7	2715·5
589	346921	204336469	24·2693	8·3825	0·00170	9	185·0	2724·7
590	348100	205379000	24·2888	8·3872	0·00169	59·0	185·4	2734·0
591	349281	206425071	24·3105	8·3919	0·00169	1	185·7	2743·2
592	350464	207474688	24·3311	8·3967	0·00169	2	186·0	2752·5
593	351649	208527857	24·3516	8·4014	0·00169	3	186·3	2761·8
594	352836	209584584	24·3721	8·4061	0·00168	4	186·6	2771·2
595	354025	210644875	24·3926	8·4108	0·00168	5	186·9	2780·5
596	355216	211708736	24·4131	8·4155	0·00168	6	187·2	2789·9
597	356409	212776173	24·4336	8·4202	0·00168	7	187·6	2799·2
598	357604	213847192	24·4540	8·4249	0·00167	8	187·9	2808·6
599	358801	214921799	24·4745	8·4296	0·00167	9	188·2	2818·0
600	360000	216000000	24·4949	8·4343	0·00167	60·0	188·5	2827·4

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
601	361201	217081801	24·5153	8·4390	0·00166	60·1	188·8	2836·9
602	362404	218167208	24·5357	8·4437	0·00166	2	189·1	2846·3
603	363609	219256227	24·5561	8·4484	0·00166	3	189·4	2855·8
604	364816	220348864	24·5764	8·4530	0·00166	4	189·8	2865·3
605	366025	221445125	24·5967	8·4577	0·00165	5	190·1	2874·8
606	367236	222545016	24·6171	8·4623	0·00165	6	190·4	2884·3
607	368449	223648543	24·6374	8·4670	0·00165	7	190·7	2893·8
608	369664	224755712	24·6577	8·4716	0·00164	8	191·0	2903·3
609	370881	225866529	24·6779	8·4763	0·00164	9	191·3	2912·9
610	372100	226981000	24·6982	8·4809	0·00164	61·0	191·6	2922·5
611	373321	228099131	24·7184	8·4856	0·00164	1	192·0	2932·1
612	374544	229220928	24·7386	8·4902	0·00163	2	192·3	2941·7
613	375769	230346397	24·7588	8·4948	0·00163	3	192·6	2951·3
614	376996	231475544	24·7790	8·4994	0·00163	4	192·9	2960·9
615	378225	232608375	24·7992	8·5040	0·00163	5	193·2	2970·6
616	379456	233744896	24·8193	8·5086	0·00162	6	193·5	2980·2
617	380689	234885113	24·8395	8·5132	0·00162	7	193·8	2989·9
618	381924	236029032	24·8596	8·5178	0·00162	8	194·2	2999·6
619	383161	237176659	24·8797	8·5224	0·00162	9	194·5	3009·3
620	384400	238328000	24·8998	8·5270	0·00161	62·0	194·8	3019·1
621	385641	239483061	24·9199	8·5316	0·00161	1	195·1	3028·8
622	386884	240641848	24·9399	8·53[illegible]2	0·00161	2	195·4	3038·6
623	388129	241804367	24·9600	8·5408	0·00161	3	195·7	3048·4
624	389376	242970624	24·9800	8·5453	0·00160	4	196·0	3058·2
625	390625	244140625	25·0000	8·5499	0·00160	5	196·3	3068·0
626	391876	245314376	25·0200	8·5544	0·00160	6	196·7	3077·8
627	393129	246491883	25·0400	8·5590	0·00159	7	197·0	3087·6
628	394384	247673152	25·0599	8·5635	0·00159	8	197·3	3097·5
629	395641	248858189	25·0799	8·5681	0·00159	9	197·6	3107·4
630	396900	250047000	25·0998	8·5726	0·00159	63·0	197·9	3117·2
631	398161	251239591	25·1197	8·5772	0·00158	1	198·2	3127·1
632	399424	252435968	25·1396	8·5817	0·00158	2	198·5	3137·1
633	400689	253636137	25·1595	8·5862	0·00158	3	198·9	3147·0
634	401956	254840104	25·1794	8·5907	0·00158	4	199·2	3157·0
635	403225	256047875	25·1992	8·5952	0·00157	5	199·5	3166·9
636	404496	257259456	25·2190	8·5997	0·00157	6	199·8	3176·9
637	405769	258474853	25·2389	8·6043	0·00157	7	200·1	3186·9
638	407044	259694072	25·2587	8·6088	0·00157	8	200·4	3196·9
639	408321	260917119	25·2784	8·6132	0·00156	9	200·7	3206·9
640	409600	262144000	25·2982	8·6177	0·00156	64·0	201·1	3217·0

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
641	410881	263374721	25·3180	8·6222	0·00156	64·1	201·4	3227·1
642	412164	264609288	25·3377	8·6267	0·00156	2	201·7	3237·1
643	413449	265847707	25·3574	8·6312	0·00156	3	202·0	3247·2
644	414736	267089984	25·3772	8·6357	0·00155	4	202·3	3257·3
645	416025	268336125	25·3969	8·6401	0·00155	5	202·6	3267·5
646	417316	269586136	25·4165	8·6446	0·00155	6	202·9	3277·6
647	418609	270840023	25·4362	8·6490	0·00155	7	203·3	3287·7
648	419904	272097792	25·4558	8·6535	0·00154	8	203·6	3297·9
649	421201	273359449	25·4755	8·6579	0·00154	9	203·9	3308·1
650	422500	274625000	25·4951	8·6624	0·00154	65·0	204·2	3318·3
651	423801	275894451	25·5147	8·6668	0·00154	1	204·5	3328·5
652	425104	277167808	25·5343	8·6713	0·00153	2	204·8	3338·8
653	426409	278445077	25·5539	8·6757	0·00153	3	205·1	3349·0
654	427716	279726264	25·5734	8·6801	0·00153	4	205·5	3359·3
655	429025	281011375	25·5930	8·6845	0·00153	5	205·8	3369·6
656	430336	282300416	25·6125	8·6890	0·00152	6	206·1	3379·9
657	431649	283593393	25·6320	8·6934	0·00152	7	206·4	3390·2
658	432964	284891312	25·6515	8·6978	0·00152	8	206·7	3400·5
659	434281	286190179	25·6710	8·7022	0·00152	9	207·0	3410·8
660	435600	287496000	25·6905	8·7066	0·00152	66·0	207·3	3421·2
661	436921	288804781	25·7099	8·7110	0·00151	1	207·7	3431·6
662	438244	290117528	25·7294	8·7154	0·00151	2	208·0	3442·0
663	439569	291434247	25·7488	8·7198	0·00151	3	208·3	3452·4
664	440896	292754944	25·7682	8·7241	0·00151	4	208·6	3462·8
665	442225	294079625	25·7876	8·7285	0·00150	5	208·9	3473·2
666	443556	295408296	25·8070	8·7329	0·00150	6	209·2	3483·7
667	444880	296740963	25·8263	8·7373	0·00150	7	209·5	3494·2
668	446224	298077632	25·8457	8·7416	0·00150	8	209·9	3504·6
669	447561	299418309	25·8650	8·7460	0·00149	9	210·2	3515·1
670	448900	300763000	25·8844	8·7503	0·00149	67·0	210·5	3525·7
671	450241	302111711	25·9037	8·7547	0·00149	1	210·8	3536·2
672	451584	303464448	25·9230	8·7590	0·00149	2	211·1	3546·7
673	452929	304821217	25·9422	8·7634	0·00149	3	211·4	3557·3
674	454276	306182024	25·9615	8·7677	0·00148	4	211·7	3567·9
675	455625	307546875	25·9808	8·7721	0·00148	5	212·1	3578·5
676	456976	308915776	26·0000	8·7764	0·00148	6	212·4	3589·1
677	458329	310288733	26·0192	8·7807	0·00148	7	212·7	3599·7
678	459684	311665752	26·0384	8·7850	0·00147	8	213·0	3610·3
679	461041	313046839	26·0576	8·7893	0·00147	9	213·3	3621·0
680	462400	314432000	26·0768	8·7937	0·00147	68·0	213·6	3631·7

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
681	463761	315821241	26·0960	8·7980	0·00147	68·1	213·9	3642·4
682	465124	317214568	26·1151	8·8023	0·00147	2	214·3	3653·1
683	466489	318611987	26·1343	8·8066	0·00146	3	214·6	3663·8
684	467856	320013504	26·1534	8·8109	0·00146	4	214·9	3674·5
685	469225	321419125	26·1725	8·8152	0·00146	5	215·2	3685·3
686	470596	322828856	26·1916	8·8194	0·00146	6	215·5	3696·1
687	471969	324242703	26·2107	8·8237	0·00146	7	215·8	3706·8
688	473344	325660672	26·2298	8·8280	0·00145	8	216·1	3717·6
689	474721	327082769	26·2488	8·8323	0·00145	9	216·5	3728·5
690	476100	328509000	26·2679	8·8366	0·00145	69·0	216·8	3739·3
691	477481	329939371	26·2869	8·8408	0·00145	1	217·1	3750·1
692	478864	331373888	26·3059	8·8451	0·00145	2	217·4	3761·0
693	480249	332812557	26·3249	8·8493	0·00144	3	217·7	3771·9
694	481636	334255384	26·3439	8·8536	0·00144	4	218·0	3782·8
695	483025	335702375	26·3629	8·8578	0·00144	5	218·3	3793·7
696	484416	337153536	26·3818	8·8621	0·00144	6	218·7	3804·6
697	485809	338608873	26·4008	8·8663	0·00143	7	219·0	3815·5
698	487204	340068392	26·4197	8·8706	0·00143	8	219·3	3826·5
699	488601	341532099	26·4386	8·8748	0·00143	9	219·6	3837·5
700	490000	343000000	26·4575	8·8790	0·00143	70·0	219·9	3848·5
701	491401	344472101	26·4764	8·8833	0·00143	1	220·2	3859·5
702	492804	345948408	26·4953	8·8875	0·00142	2	220·5	3870·5
703	494209	347428927	26·5141	8·8917	0·00142	3	220·9	3881·5
704	495616	348913664	26·5330	8·8959	0·00142	4	221·2	3892·6
705	497025	350402625	26·5518	8·9001	0·00142	5	221·5	3903·6
706	498436	351895816	26·5707	8·9043	0·00142	6	221·8	3914·7
707	499849	353393243	26·5895	8·9085	0·00141	7	222·1	3925·8
708	501264	354894912	26·6083	8·9127	0·00141	8	222·4	3936·9
709	502681	356400829	26·6271	8·9169	0·00141	9	222·7	3948·0
710	504100	357911000	26·6458	8·9211	0·00141	71·0	223·1	3959·2
711	505521	359425431	26·6646	8·9253	0·00141	1	223·4	3970·4
712	506944	360944128	26·6833	8·9295	0·00140	2	223·7	3981·5
713	508369	362467097	26·7021	8·9337	0·00140	3	224·0	3992·7
714	509796	363994344	26·7208	8·9378	0·00140	4	224·3	4003·9
715	511225	365525875	26·7395	8·9420	0·00140	5	224·6	4015·2
716	512656	367061696	26·7582	8·9462	0·00140	6	224·9	4026·4
717	514089	368601813	26·7769	8·9503	0·00139	7	225·3	4037·6
718	515524	370146232	26·7955	8·9545	0·00139	8	225·6	4048·9
719	516961	371694959	26·8142	8·9587	0·00139	9	225·9	4060·2
720	518400	373248000	26·8328	8·9628	0·00139	72·0	226·2	4071·5

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^2	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
721	519841	374805361	26·8514	8·9670	0·00139	72·1	226·5	4082·8
722	521284	376367048	26·8701	8·9711	0·00139	2	226·8	4094·2
723	522729	377933067	26·8887	8·9752	0·00138	3	227·1	4105·5
724	524176	379503424	26·9072	8·9794	0·00138	4	227·5	4116·9
725	525625	381078125	26·9258	8·9835	0·00138	5	227·8	4128·2
726	527076	382657176	26·9444	8·9876	0·00138	6	228·1	4139·6
727	528529	384240583	26·9629	8·9918	0·00138	7	228·4	4151·1
728	529984	385828352	26·9815	8·9959	0·00137	8	228·7	4162·5
729	531441	387420489	27·0000	9·0000	0·00137	9	229·0	4173·9
730	532900	389017000	27·0185	9·0041	0·00137	73·0	229·3	4185·4
731	534361	390617891	27·0370	9·0082	0·00137	1	229·7	4196·9
732	535824	392223168	27·0555	9·0123	0·00137	2	230·0	4208·4
733	537289	393832837	27·0740	9·0164	0·00136	3	230·3	4219·9
734	538756	395446904	27·0924	9·0205	0·00136	4	230·6	4231·4
735	540225	397065375	27·1109	9·0246	0·00136	5	230·9	4242·9
736	541696	398688256	27·1293	9·0287	0·00136	6	231·2	4254·5
737	543169	400315553	27·1477	9·0328	0·00136	7	231·5	4266·0
738	544644	401947272	27·1662	9·0369	0·00136	8	231·8	4277·6
739	546121	403583419	27·1846	9·0410	0·00135	9	232·2	4289·2
740	547600	405224000	27·2029	9·0450	0·00135	74·0	232·5	4300·8
741	549081	406869021	27·2213	9·0491	0·00135	1	232·8	4312·8
742	550564	408518488	27·2397	9·0532	0·00135	2	233·1	4324·1
743	552049	410172407	27·2580	9·0572	0·00135	3	233·4	4335·8
744	553536	411830784	27·2764	9·0613	0·00134	4	233·7	4347·5
745	555025	413493625	27·2947	9·0654	0·00134	5	234·0	4359·2
746	556516	415160936	27·3130	9·0694	0·00134	6	234·4	4370·9
747	558009	416832723	27·3313	9·0735	0·00134	7	234·7	4382·6
748	559504	418508992	27·3496	9·0775	0·00134	8	235·0	4394·3
749	561001	420189749	27·3679	9·0816	0·00134	9	235·3	4406·1
750	562500	421875000	27·3861	9·0856	0·00133	75·0	235·6	4417·6
751	564001	423564751	27·4014	9·0896	0·00133	1	235·9	4429·7
752	565504	425259008	27·4226	9·0937	0·00133	2	236·2	4441·5
753	567009	426957777	27·4408	9·0977	0·00133	3	236·6	4453·3
754	568516	428661064	27·4591	9·1017	0·00133	4	236·9	4465·1
755	570025	430368875	27·4773	9·1057	0·00132	5	237·2	4477·0
756	571536	432081216	27·4955	9·1098	0·00132	6	237·5	4488·8
757	573049	433798093	27·5136	9·1138	0·00122	7	237·8	4500·7
758	574564	435519512	27·5318	9·1178	0·00132	8	238·1	4512·6
759	576081	437245479	27·5500	9·1218	0·00132	9	238·4	4524·5
760	577600	438976000	27·5681	9·1258	0·00132	76·0	238·8	4536·5

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
761	579121	440711081	27·5862	9·1298	0·00131	76·1	239·1	4548·4
762	580644	442450728	27·6043	9·1338	0·00131	2	239·4	4560·4
763	582169	444194947	27·6225	9·1378	0·00131	3	239·7	4572·3
764	583696	445943744	27·6405	9·1418	0·00131	4	240·0	4584·3
765	585225	447697125	27·6586	9·1458	0·00131	5	240·3	4596·3
766	586756	449455096	27·6767	9·1498	0·00131	6	240·6	4608·4
767	588289	451217663	27·6948	9·1537	0·00130	7	241·0	4620·4
768	589824	452984832	27·7128	9·1577	0·00130	8	241·3	4632·5
769	591361	454756609	27·7308	9·1617	0·00130	9	241·6	4644·5
770	592900	456533000	27·7489	9·1657	0·00130	77·0	241·9	4656·6
771	594441	458314011	27·7669	9·1696	0·00130	1	242·2	4668·7
772	595984	460099648	27·7849	9·1736	0·00130	2	242·5	4680·8
773	597529	461889917	27·8029	9·1775	0·00129	3	242·8	4693·0
774	599076	463684824	27·8209	9·1815	0·00129	4	243·2	4705·1
775	600625	465484375	27·8388	9·1855	0·00129	5	243·5	4717·3
776	602176	467288576	27·8568	9·1894	0·00129	6	243·8	4729·5
777	603729	469097433	27·8747	9·1933	0·00129	7	244·1	4741·7
778	605284	470910952	27·8927	9·1973	0·00129	8	244·4	4753·9
779	606841	472729139	27·9106	9·2012	0·00128	9	244·7	4766·1
780	608400	474552000	27·9285	9·2052	0·00128	78·0	245·0	4778·4
781	609961	476379541	27·9464	9·2091	0·00128	1	245·4	4790·6
782	611524	478211768	27·9643	9·2130	0·00128	2	245·7	4802·9
783	613089	480048687	27·9821	9·2170	0·00128	3	246·0	4815·2
784	614656	481890304	28·0000	9·2209	0·00128	4	246·3	4827·5
785	616225	483736625	28·0179	9·2248	0·00127	5	246·6	4839·8
786	617796	485587656	28·0357	9·2287	0·00127	6	246·9	4852·2
787	619369	487443403	28·0535	9·2326	0·00127	7	247·2	4864·5
788	620944	489303872	28·0713	9·2365	0·00127	8	247·6	4876·9
789	622521	491169069	28·0891	9·2404	0·00127	9	247·9	4889·3
790	624100	493039000	28·1069	9·2443	0·00127	79·0	248·2	4901·7
791	625681	494913671	28·1247	9·2482	0·00126	1	248·5	4914·1
792	627264	496793088	28·1425	9·2521	0·00126	2	248·8	4926·5
793	628849	498677257	28·1603	9·2560	0·00126	3	249·1	4939·0
794	630436	500566184	28·1780	9·2599	0·00126	4	249·4	4951·4
795	632025	502459875	28·1957	9·2638	0·00126	5	249·8	4963·9
796	633616	504358336	28·2135	9·2677	0·00126	6	250·1	4976·4
797	635209	506261573	28·2312	9·2716	0·00125	7	250·4	4988·9
798	636804	508169592	28·2489	9·2754	0·00125	8	250·7	5001·4
799	638401	510082399	28·2666	9·2793	0·00125	9	251·0	5014·0
800	640000	512000000	28·2843	9·2832	0·00125	80·0	251·3	5026·5

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4} d^2$
801	641601	513922401	28·3019	9·2870	0·00125	80·1	251·6	5039·1
802	643204	515849608	28·3196	9·2909	0·00125	2	252·0	5051·7
803	644809	517781627	28·3373	9·2948	0·00125	3	252·3	5064·3
804	646416	519718464	28·3549	9·2986	0·00124	4	252·6	5076·9
805	648025	521660125	28·3725	9·3025	0·00124	5	252·9	5089·6
806	649636	523606616	28·3901	9·3063	0·00124	6	253·2	5102·2
807	651249	525557943	28·4077	9·3102	0·00124	7	253·5	5114·9
808	652864	527514112	28·4253	9·3140	0·00124	8	253·8	5127·6
809	654481	529475129	28·4429	9·3179	0·00124	9	254·2	5140·3
810	656100	531441000	28·4605	9·3217	0·00123	81·0	254·5	5153·0
811	657721	533411731	28·4781	9·3255	0·00123	1	254·8	5165·7
812	659344	535387328	28·4956	9·3294	0·00123	2	255·1	5178·5
813	660969	537367797	28·5132	9·3332	0·00123	3	255·4	5191·2
814	662596	539353144	28·5307	9·3370	0·00123	4	255·7	5204·0
815	664225	541343375	28·5482	9·3408	0·00123	5	256·0	5216·8
816	665856	543338496	28·5657	9·3447	0·00123	6	256·4	5229·6
817	667489	545338513	28·5832	9·3485	0·00122	7	256·7	5242·4
818	669124	547343432	28·6007	9·3523	0·00122	8	257·0	5255·3
819	670761	549353259	28·6182	9·3561	0·00122	9	257·3	5268·1
820	672400	551368000	28·6356	9·3599	0·00122	82·0	257·6	5281·0
821	674041	553387661	28·6531	9·3637	0·00122	1	257·9	5293·9
822	675684	555412248	28·6705	9·3675	0·00122	2	258·2	5306·8
823	677329	557441767	28·6880	9·3713	0·00122	3	258·6	5319·7
824	678976	559476224	28·7054	9·3751	0·00121	4	258·9	5332·7
825	680625	561515625	28·7228	9·3789	0·00121	5	259·2	5345·6
826	682276	563559976	28·7402	9·3827	0·00121	6	259·5	5358·6
827	683929	565609283	28·7576	9·3865	0·00121	7	259·8	5371·6
828	685584	567663552	28·7750	9·3902	0·00121	8	260·1	5384·6
829	687241	569722789	28·7924	9·3940	0·00121	9	260·4	5397·6
830	688900	571787000	28·8097	9·3978	0·00120	83·0	260·8	5410·6
831	690561	573856191	28·8271	9·4016	0·00120	1	261·1	5423·7
832	692224	575930368	28·8444	9·4053	0·00120	2	261·4	5436·7
833	693889	578009537	28·8617	9·4091	0·00120	3	261·7	5449·8
834	695556	580093704	28·8791	9·4129	0·00120	4	262·0	5462·9
835	697225	582182875	28·8964	9·4166	0·00120	5	262·3	5476·0
836	698896	584277056	28·9137	9·4204	0·00120	6	262·6	5489·1
837	700569	586376253	28·9310	9·4241	0·00119	7	263·0	5502·3
838	702244	588480472	28·9482	9·4279	0·00119	8	263·3	5515·4
839	703921	590589719	28·9655	9·4316	0·00119	9	263·6	5528·6
840	705600	592704000	28·9828	9·4354	0·00119	84·0	263·9	5541·8

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi d^2}{4}$
841	707281	594823321	29·0000	9·4391	0·00119	84·1	264·2	5555·0
842	708964	596947688	29·0172	9·4429	0·00119	2	264·5	5568·2
843	710649	599077107	29·0345	9·4466	0·00119	3	264·8	5581·4
844	712336	601211584	29·0517	9·4503	0·00118	4	265·2	5594·7
845	714025	603351125	29·0689	9·4541	0·00118	5	265·5	5607·9
846	715716	605495736	29·0861	9·4578	0·00118	6	265·8	5621·2
847	717409	607645423	29·1033	9·4615	0·00118	7	266·1	5634·5
848	719104	609800192	29·1204	9·4652	0·00118	8	266·4	5647·8
849	720801	611960049	29·1376	9·4690	0·00118	9	266·7	5661·2
850	722500	614125000	29·1548	9·4727	0·00118	85·0	267·0	5674·5
851	724201	616295051	29·1719	9·4764	0·00118	1	267·3	5687·9
852	725904	618470208	29·1890	9·4801	0·00117	2	267·7	5701·2
853	727609	620650477	29·2062	9·4838	0·00117	3	268·0	5714·6
854	729316	622835864	29·2233	9·4875	0·00117	4	268·3	5728·0
855	731025	625026375	29·2404	9·4912	0·00117	5	268·6	5741·5
856	732736	627222016	29·2575	9·4949	0·00117	6	268·9	5754·9
857	734449	629422793	29·2746	9·4986	0·00117	7	269·2	5768·3
858	736164	631628712	29·2916	9·5023	0·00117	8	269·5	5781·8
859	737881	633839779	29·3087	9·5060	0·00116	9	269·0	5795·3
860	739600	636056000	29·3258	9·5097	0·00116	86·0	270·2	5808·8
861	741321	638277381	29·3428	9·5134	0·00116	1	270·5	5822·3
862	743044	640503928	29·3598	9·5171	0·00116	2	270·8	5835·9
863	744769	642735647	29·3769	9·5207	0·00116	3	271·1	5849·4
864	746496	644972544	29·3939	9·5244	0·00116	4	271·4	5863·0
865	748225	647214625	29·4109	9·5281	0·00116	5	271·7	5876·5
866	749956	649461896	29·4279	9·5317	0·00115	6	272·1	5890·1
867	751689	651714363	29·4449	9·5354	0·00115	7	272·4	5903·8
868	753424	653972032	29·4618	9·5391	0·00115	8	272·7	5917·4
869	755161	656234909	29·4788	9·5427	0·00115	9	273·0	5931·0
870	756900	658503000	29·4958	9·5464	0·00115	87·0	273·3	5944·7
871	758641	660776311	29·5127	9·5501	0·00115	1	273·6	5958·4
872	760384	663054848	29·5296	9·5537	0·00115	2	273·9	5972·0
873	762129	665338617	29·5466	9·5574	0·00115	3	274·3	5985·7
874	763876	667627624	29·5635	9·5610	0·00114	4	274·6	5999·5
875	765625	669921875	29·5804	9·5647	0·00114	5	274·9	6013·2
876	767376	672221376	29·5973	9·5683	0·00114	6	275·2	6027·0
877	769129	674526133	29·6142	9·5719	0·00114	7	275·5	6040·7
878	770884	676836152	29·6311	9·5756	0·00114	8	275·8	6054·5
879	772641	679151439	29·6479	9·5792	0·00114	9	276·1	6068·3
880	774400	681472000	29·6648	9·5828	0·00114	88·0	276·5	6082·1

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
881	776161	683797841	29·6816	9·5865	0·00114	88·1	276·8	6096·0
882	777924	686128968	29·6985	9·5901	0·00113	2	277·1	6109·8
883	779689	688465387	29·7153	9·5937	0·00113	3	277·4	6123·7
884	781456	690807104	29·7321	9·5973	0·00113	4	277·7	6137·5
885	783225	693154125	29·7489	9·6010	0·00113	5	278·0	6151·4
886	784996	695506456	29·7658	9·6046	0·00113	6	278·3	6165·3
887	786769	697864103	29·7825	9·6082	0·00113	7	278·7	6179·3
888	788544	700227072	29·7993	9·6118	0·00113	8	279·0	6193·2
889	790321	702595369	29·8161	9·6154	0·00112	9	279·3	6207·2
890	792100	704969000	29·8329	9·6190	0·00112	89·0	279·6	6221·1
891	793881	707347971	29·8496	9·6226	0·00112	1	279·9	6235·1
892	795664	709732288	29·8664	9·6262	0·00112	2	280·2	6249·1
893	797449	712121957	29·8831	9·6298	0·00112	3	280·5	6263·1
894	799236	714516984	29·8998	9·6334	0·00112	4	280·9	6277·2
895	801025	716917375	29·9166	9·6370	0·00112	5	281·2	6291·2
896	802816	719323136	29·9333	9·6406	0·00112	6	281·5	6305·3
897	804609	721734273	29·9500	9·6442	0·00111	7	281·8	6319·4
898	806404	724150792	29·9666	9·6477	0·00111	8	282·1	6333·5
899	808201	726572699	29·9833	9·6513	0·00111	9	282·4	6347·6
900	810000	729000000	30·0000	9·6549	0·00111	90·0	282·7	6361·7
901	811801	731432701	30·0167	9·6585	0·00111	1	283·1	6375·9
902	813604	733870808	30·0333	9·6620	0·00111	2	283·4	6390·0
903	815409	736314327	30·0500	9·6656	0·00111	3	283·7	6404·2
904	817216	738763264	30·0666	9·6692	0·00111	4	284·0	6418·4
905	819025	741217625	30·0832	9·6729	0·00110	5	284·3	6432·6
906	820836	743677416	30·0998	9·6763	0·00110	6	284·6	6446·8
907	822649	746142643	30·1164	9·6799	0·00110	7	284·9	6461·1
908	824464	748613312	30·1330	9·6834	0·00110	8	285·3	6475·3
909	826281	751089429	30·1496	9·6870	0·00110	9	285·6	6489·6
910	828100	753571000	30·1662	9·6905	0·00110	91·0	285·9	6503·9
911	829921	756058031	30·1828	9·6941	0·00110	1	286·2	6518·2
912	831744	758550528	30·1993	9·6976	0·00110	2	286·5	6532·5
913	833569	761048497	30·2159	9·7012	0·00110	3	286·8	6546·8
914	835396	763551944	30·2324	9·7047	0·00109	4	287·1	6561·2
915	837225	766060875	30·2490	9·7082	0·00109	5	287·5	6575·5
916	839056	768575296	30·2655	9·7118	0·00109	6	287·8	6589·8
917	840889	771095213	30·2820	9·7153	0·00109	7	288·1	6604·3
918	842724	773620632	30·2985	9·7188	0·00109	8	288·4	6618·7
919	844561	776151559	30·3150	9·7224	0·00109	9	288·7	6633·2
920	846400	778688000	30·3315	9·7259	0·00109	92·0	289·0	6647·6

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4}d^2$
921	848241	781229961	30·3480	9·7294	0·00109	92·1	289·3	6662·1
922	850084	783777448	30·3645	9·7329	0·00108	2	289·7	6676·5
923	851929	786330467	30·3809	9·7364	0·00108	3	290·0	6691·0
924	853776	788889024	30·3974	9·7400	0·00108	4	230·3	6705·5
925	855625	791453125	30·4138	9·7435	0·00108	5	290·6	6720·1
926	857476	794022776	30·4302	9·7470	0·00108	6	290·9	6734·6
927	859329	796597983	30·4467	9·7505	0·00108	7	291·2	6749·2
928	861184	799178752	30·4631	9·7540	0·00108	8	291·5	6763·7
929	863041	801765089	30·4795	9·7575	0·00108	9	291·9	6778·3
930	864900	804357000	30·4959	9·7610	0·00108	93·0	292·2	6792·9
931	866761	806954491	30·5123	9·7645	0·00107	1	292·5	6807·5
932	868624	809557568	30·5287	9·7680	0·00107	2	292·8	6822·2
933	870489	812166237	30·5450	9·7715	0·00107	3	293·1	6836·8
934	872356	814780504	30·5614	9·7750	0·00107	4	293·4	6851·5
935	874225	817400375	30·5778	9·7785	0·00107	5	293·7	6866·1
936	876096	820025856	30·5941	9·7819	0·00107	6	294·1	6880·8
937	877969	822656953	30·6105	9·7854	0·00107	7	294·4	6895·6
938	879844	825293672	30·6268	9·7889	0·00107	8	294·7	6910·3
939	881721	827936019	30·6431	9·7924	0·00106	9	295·0	6925·0
940	883600	830584000	30·6594	9·7959	0·00106	94·0	295·3	6939·8
941	885481	833237621	30·6757	9·7993	0·00106	1	295·6	6954·6
942	887364	835896888	30·6920	9·8028	0·00106	2	295·9	6969·3
943	889249	838561807	30·7083	9·8063	0·00106	3	296·3	6984·1
944	891136	841232384	30·7246	9·8097	0·00106	4	296·6	6999·0
945	893025	843908625	30·7409	9·8132	0·00106	5	296·9	7013·8
946	894916	846590536	30·7571	9·8167	0·00106	6	297·2	7028·7
947	896809	849278123	30·7734	9·8201	0·00106	7	297·5	7043·5
948	898704	851971392	30·7896	9·8236	0·00105	8	297·8	7058·4
949	900601	854670349	30·8058	9·8270	0·00105	9	298·1	7073·3
950	902500	857375000	30·8221	9·8305	0·00105	95·0	298·5	7088·2
951	904401	860085351	30·8383	9·8339	0·00105	1	298·8	7103·1
952	906304	862801408	30·8545	9·8374	0·00105	2	299·1	7118·1
953	908209	865523177	30·8707	9·8408	0·00105	3	299·4	7133·1
954	910116	868250664	30·8869	9·8443	0·00105	4	299·7	7148·0
955	912025	870983875	30·9031	9·8477	0·00105	5	300·0	7163·0
956	913936	873722816	30·9192	9·8511	0·00105	6	300·3	7178·0
957	915849	876467493	30·9354	9·8546	0·00104	7	300·7	7193·1
958	917764	879217912	30·9516	9·8580	0·00104	8	301·0	7208·1
959	919681	881974079	30·9677	9·8614	0·00104	9	301·3	7223·2
960	921600	884736000	30·9839	9·8648	0·00104	96·0	301·6	7238·2

TABLE No. 216—*continued.*

No. x	Square x^2	Cube x^3	Square Root $\sqrt{x}$	Cube Root $\sqrt[3]{x}$	Reciprocal $\frac{1}{x}$	Diam. d	Circumference of Circle πd	Area of Circle $\frac{\pi}{4} d^2$
961	923521	887503681	31·0000	9·8683	0·00104	96·1	301·9	7253·3
962	925444	890277128	31·0161	9·8717	0·00104	2	302·2	7268·4
963	927369	893056347	31·0322	9·8451	0·00104	3	302·5	7283·5
964	929296	895841344	31·0483	9·8785	0·00104	4	302·8	7298·7
965	931225	898632125	31·0644	9·8819	0·00104	5	303·2	7313·8
966	933156	901428696	31·0805	9·8854	0·00104	6	303·5	7329·0
967	935089	904231063	31·0966	9·8888	0·00103	7	303·8	7344·2
968	937024	907039232	31·1127	9·8922	0·00103	8	304·1	7359·4
969	938961	909853209	31·1288	9·8956	0·00103	9	304·4	7374·6
970	940900	912673000	31·1448	9·8990	0·00103	97·0	304·7	7389·8
971	942841	915498611	31·1609	9·9024	0·00103	1	305·0	7405·1
972	944784	918330048	31·1769	9·9058	0·00103	2	305·4	7420·3
973	946729	921167317	31·1929	9·9092	0·00103	3	305·7	7435·6
974	948676	924010424	31·2090	9·9126	0·00103	4	306·0	7450·9
975	950625	926859375	31·2250	9·9160	0·00103	5	306·3	7466·2
976	952576	929714176	31·2410	9·9194	0·00102	6	306·6	7481·5
977	954529	932574833	31·2570	9·9227	0·00102	7	306·9	7496·9
978	956484	935441352	31·2730	9·9261	0·00102	8	307·2	7512·2
979	958141	938312739	31·2890	9·9295	0·00102	9	307·6	7527·6
980	960400	941192000	31·3050	9·9329	0·00102	98·0	307·9	7543·0
981	962361	944076141	31·3209	9·9363	0·00102	1	308·2	7558·4
982	964324	946966168	31·3369	9·9396	0·00102	2	308·5	7573·8
983	966289	949862087	31·3528	9·9430	0·00102	3	308·8	7589·2
984	968256	952763904	31·3688	9·9464	0·00102	4	309·1	7604·7
985	970225	955671625	31·3847	9·9497	0·00102	5	309·4	7620·1
986	972196	958585256	31·4006	9·9531	0·00101	6	309·8	7635·6
987	974169	961504803	31·4166	9·9565	0·00101	7	310·1	7651·1
988	976144	964430272	31·4325	9·9598	0·00101	8	310·4	7676·6
989	978121	967361669	31·4484	9·9632	0·00101	9	310·7	7682·1
990	980100	970299000	31·4643	9·9666	0·00101	99·0	311·0	7697·7
991	982081	973242271	31·4802	9·9699	0·00101	1	311·3	7713·2
992	984064	976191488	31·4960	9·9733	0·00101	2	311·6	7728·8
993	986049	979146657	31·5119	9·9766	0·00101	3	312·0	7744·4
994	988036	982107784	31·5278	9·9800	0·00101	4	312·3	7760·0
995	990025	985074875	31·5436	9·9833	0·00101	5	312·6	7775·6
996	992016	988047936	31·5595	9·9866	0·00100	6	312·9	7791·3
997	994009	991026973	31·5753	9·9900	0·00100	7	313·2	7806·9
998	996004	994011992	31·5911	9·9933	0·00100	8	313·5	7822·6
999	998001	997002999	31·6070	9·9967	0·00100	9	313·8	7838·3
1000	1000000	1000000000	31·6228	10·0000	0·00100	100·0	314·2	7854·0

To convert:—

Inches to centimetres	multiply by	2·54
Centimetres to inches	,,	0·3937
Inches to millimetres	,,	25·399
Millimetres to inches	,,	0·03937
Yards to metres	,,	0·9144
Metres to yards	,,	1·0936
Feet to metres	,,	0·30478
Metres to feet	,,	3·3
Feet to links	,,	1·5151
Statute miles to kilometres	,,	1·60927
Kilometres to statute miles	,,	0·62137
Statute miles to nautical miles	,,	0·8673
Nautical miles to statute miles	,,	1·153
Nautical miles to kilometres	,,	1·8553
Kilometres to nautical miles	,,	0·5388
Kilometres to yards	,,	1093·6
Yards to kilometres	,,	0·0009145
Millimetres to mils	,,	39·4
Mils to millimetres	,,	0·0254
Nautical miles to yards	,,	2029
Yards to nautical miles	,,	0·0004928
Square inches to square centimetres	,,	6·4516
Square centimetres to square inches	,,	0·155
Square yards to square metres	,,	0·836126
Square metres to square yards	,,	1·196
Square inches to square millimetres	,,	645·16
Square millimetres to square inches	,,	0·00155
Acres to square metres	,,	4048
Acres to square yards	,,	4840
Square feet to square links	,,	2·2954
Square feet to square metres	,,	0·09
Square metres to square feet	,,	10·76
Cubic metres to cubic yards	,,	1·30795
Cubic yards to cubic metres	,,	0·76455
Cubic inches to cubic centimetres	,,	16·387
Cubic centimetres to cubic inches	,,	0·06102
Cubic feet to cubic metres	,,	0·0283
Cubic metres to cubic feet	,,	35·315
Cubic feet to litres	,,	28·3
Litres to cubic feet	,,	0·035
Imperial gallons to litres	,,	4·541
Imperial gallons to cubic metres	,,	0·0045
Cubic metres to imperial gallons	,,	220
Cubic feet to imperial gallons	,,	6·2355
Imperial gallons to cubic feet	,,	0·1605
Imperial gallons of fresh water to lb. avoirdupois	,,	10·0
Lb avoirdupois of fresh water to imperial gallons	,,	0·1
Lb. avoirdupois of fresh water to litres	,,	0·454
Litres of fresh water to lb. avoirdupois	,,	2·2
Cubic feet of fresh water to lb. avoirdupois	,,	62·425
Lb. avoirdupois of fresh water to cubic feet	,,	0·016
Cubic feet of sea water to lb. avoirdupois	,,	64·05
Cubic centimetres of fresh water to grammes	,,	1·000

To convert:—

Imperial gallons to cubic inches	multiply by	277·27
American gallons to imperial gallons	"	0·8325
American gallons to cubic inches	"	231
Grammes to grains	"	15·44
Grains to grammes	"	0·065
Tons to kilogrammes	"	1016
Kilogrammes to tons	"	0·000984
Ounces to grammes	"	28·35
Grammes to ounces	"	0·035
Lb. avoirdupois to grains troy	"	7000
Lb. avoirdupois to kilogrammes	"	0·4536
Kilogrammes to lb. avoirdupois	"	2·2046
Tons to tonneaux	"	1·0160
Tonneaux to tons	"	0·9842
Grammes to lb. avoirdupois	"	0·0022046
Lb. avoirdupois to grammes	"	453·5924
Cwt. to kilogrammes	"	50·8
Kilogrammes to cwt.	"	0·01968
Kilogrammes to ounces	"	35·3
American tons to lb.	"	2000
American tons to English tons	"	0·8928
American tons to tonneaux	"	0·908
Grammes per metre to lb. per statute mile	"	3·548
Kilogrammes per kilometre to lb. per statute mile	"	3·548
Grammes per metre to lb. per nautical mile	"	4·091
Grammes per foot to lb. per statute mile	"	11·64
Lb. per nautical mile to kilogrammes per kilometre	"	0·2445
Lb. per square inch to grammes per square centimetre	"	70·3
Grammes per square centimetre to lb. per square inch	"	0·01422
Lb. per square inch to head of water in feet	"	2·3
Head of water in feet to lb. per square inch	"	0·43
Lb. per square inch to head of water in metres	"	0·7
Head of water in metres to lb. per square inch	"	1·4
Lb. per square inch to atmospheres	"	0·07
Atmospheres to lb. per square inch	"	14·7
Kilogrammes per square millimetres to lb. per square inch	"	1422·3
Lb. per square inch to kilogrammes per square millimetre	"	0·000703
Tons per square feet to kilogrammes per square centimetre	"	1·09
Tons per square feet to lb. per square inch	"	15·5
Atmosphere to kilogrammes per square centimetre	"	1·033
Kilogrammes per square centimetre to atmospheres	"	0·967
Tons per square foot to head of water in feet	"	36
Tons per square inch to kilogrammes per square millimetre	"	1·575
Kilogrammes per square millimetre to tons per square inch	"	0·6347
Joules to foot lb.	"	0·737

To convert:—

Foot lb. to Joules	multiply by	1·35
Lb. degrees Fahrenheit to foot lb.	”	772
Lb. degrees Fahrenheit to kilogrammes	”	107
Kilogrammetres to foot lb.	”	7·2178
Foot lb. to kilogrammetres	”	0·13825
Horse power to watts	”	746
Watts to horse power	”	0·00134
Horse power to foot lb. per minute	”	33000
Horse power to kilogrammetres per second	”	76·0
Watts to foot lb. per minute	”	44
Watts to kilogrammetres per second	”	0·1
Joules to kilogrammetres	”	0·1
Kilogrammetres to Joules	”	9·8
Pferdestärke to horse power	”	0·987
Horse power to Pferdestärke	”	1·013
Pferdestärke to watts	”	736
Miles per hour to feet per minute	”	88
Feet per minute to miles per hour	”	0·0113
Metres per second to feet per minute	”	197
Feet per minute to metres per second	”	0·005
Fahrenheit to Réaumur	$\frac{4}{9}(F.^\circ - 32^\circ) = R.^\circ$	
Réaumur to Fahrenheit	$(R.^\circ \times \frac{9}{4}) + 32^\circ = F.^\circ$	
Fahrenheit to Celsius	$\frac{5}{9}(F.^\circ - 32^\circ) = C.^\circ$	
Celsius to Fahrenheit	$(\frac{9}{5} C.^\circ) + 32^\circ = F.^\circ$	
Celsius to Réaumur	$\frac{4}{5} \times C.^\circ = R.^\circ$	
Réaumur to Celsius	$\frac{5}{4} \times R.^\circ = C.^\circ$	
Common to hyperbolic logs.	multiply by	2·30258
Hyperbolic to common logs.	”	0·43429

Table No 155.—Construction Data and Prices of Three-Core, Sector-Conductor, Low Tension, Paper Insulated, Lead-covered Cables. Thicknesses according to the Rules of the Cable Makers' Association.

Based on: Copper at £60 per ton; Lead at £1 4s. per 100 kilogrammes; Paper and Impregnating Compound at £2 per 100 kilogrammes.

Area of each Conductor		Number and Diameter of Wires			Diam. over conductor, mm.	Copper		Paper thickness Cu/Cu and Cu/Pb.		Diameter over Paper of Core		Paper		Impregnating Compound		Diameter over the Three Cores	
sq. in.	sq. mm.	No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.
0·025	16·13	7	0·067	1·71	5·1	144	184	0·09	2·3	7·4	0·291	25	10	20	8	13·8	0·543
·050	32·26	19	·058	1·47	7·4	287	367	·09	2·3	9·7	·382	34	14	27	11	18·1	·713
·075	48·4	19	·071	1·80	9·0	431	552	·09	2·3	11·3	·445	40	16	32	13	21·1	·831
·100	64·5	19	·082	2·08	10·4	575	736	·10	2·5	12·9	·508	50	20	40	16	24·1	·949
·125	80·6	19	·091	2·32	11·6	718	919	·10	2·5	14·1	·555	56	22	45	18	26·3	1·04
·150	96·8	37	·072	1·83	12·8	862	1103	·10	2·5	15·3	·602	61	24	49	20	28·5	1·12
·200	129	37	·083	2·11	14·8	1150	1472	·10	2·5	17·3	·681	69	28	55	22	32·3	1·27
·250	161	37	·093	2·35	16·5	1436	1838	·11	2·8	19·3	·760	87	35	70	28	36·0	1·42
·300	194	37	·102	2·58	18·1	1724	2207	·11	2·8	20·9	·823	94	38	75	30	39·0	1·54
·350	226	37	·109	2·78	19·5	2013	2577	·11	2·8	22·3	·878	101	40	81	32	41·6	1·64
·400	258	61	·091	2·32	20·9	2299	2943	·11	2·8	23·7	·933	108	43	86	34	44·2	1·74
·500	323	61	·102	2·59	23·3	2875	3680	·11	2·8	26·1	1·03	120	48	96	38	48·6	1·91

Area of each Conductor	Three Cores laid up		1 per cent. for Lay		Diameter over Outer Paper		Paper		Impregnating Compound		Thickness of Lead		Diameter over Lead		Lead		Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price in shillings per		
sq. in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.						kilometre	1000 yards	statute mile
0·025	567	606	6	6	16·1	0·634	59	24	47	19	2·05	0·08	20·2	0·795	1329	319	2008	974	24	130	130	1258	1151	2024
·050	1044	1176	10	12	20·4	·803	77	31	62	25	2·3	·09	25·0	·984	1864	447	3057	1691	42	162	243	2138	1955	3440
·075	1509	1743	15	17	23·4	·921	89	36	71	28	2·55	·10	28·5	1·16	2363	567	4047	2391	60	192	288	2931	2680	4716
·100	1995	2316	20	23	26·6	1·05	110	44	88	35	2·55	·10	31·7	1·25	2656	637	4869	3055	77	226	395	3753	3432	6039
·125	2457	2877	25	29	28·8	1·13	119	48	95	38	2·8	·11	34·4	1·35	3106	745	5802	3737	94	258	452	4541	4152	7307
·150	2916	3441	29	34	31·0	1·22	128	51	102	41	2·8	·11	36·6	1·44	3384	812	6559	4379	110	288	504	5281	4829	8498
·200	3822	4566	38	46	34·8	1·37	145	58	116	46	3·05	·12	40·9	1·62	4124	990	8245	5706	143	350	700	6899	6309	11104
·250	4779	5703	48	57	38·8	1·53	181	72	145	58	3·3	·13	45·4	1·79	4964	1192	10117	7082	177	410	820	8489	7762	13660
·300	5679	6825	57	68	41·8	1·65	196	78	157	63	3·3	·13	48·4	1·91	5314	1275	11403	8309	208	476	952	9945	9094	16010
·350	6585	7947	66	79	44·4	1·75	208	83	166	66	3·55	·14	51·5	2·03	6081	1460	13106	9635	241	536	1072	11484	10500	18480
·400	7479	9060	75	91	47·0	1·85	221	88	177	71	3·55	·14	54·1	2·13	6410	1539	14362	10849	271	600	1200	12920	11815	20790
·500	9273	11298	93	113	51·4	2·02	242	97	194	78	3·8	·15	59·0	2·32	7493	1799	17295	13385	335	720	1440	15880	14520	25554

Table No. 160.—Construction Data and Prices of Three-Core, Sector-Conductor, Paper Insulated, Lead-covered Cables for 2200 Volts Working. Thicknesses according to the Rules of the Cable Makers' Association.

Based on: Copper at £60 per ton; Lead at £1 4s. per 100 kilogrammes; Paper and Impregnating Compound at £2 per 100 kilogrammes.

Area of each Conductor, sq. in.	Area of each Conductor, sq. mm.	Number and Diameter of Wires, No.	Number and Diameter of Wires, in.	Number and Diameter of Wires, mm.	Diam. over Conductor, mm.	Copper, Weight, kilog. per km.	Copper, Price, shillings per km.	Paper, thickness in in., Copper to Copper	Paper, thickness in in., Copper to Lead	Diameter over Paper of Core, mm.	Diameter over Paper of Core, in.	Paper, Weight, kilog. per km.	Paper, Price, shillings per km.	Impregnating Compound, Weight, kilog. per km.	Impregnating Compound, Price, shillings per km.	Diameter over the Three Cores, mm.	Diameter over the Three Cores, in.	Three Cores laid up, Weight, kilog. per km.	Three Cores laid up, Price, shillings per km.	1 per cent. for lay, Weight, kilog. per km.	1 per cent. for lay, Price, shillings per km.	Diameter over Outer Paper, mm.	Diameter over Outer Paper, in.	Paper, Weight, kilog. per km.	Paper, Price, shillings per km.	Impregnating Compound, Weight, kilog. per km.	Impregnating Compound, Price, shillings per km.	Thickness of Lead, mm.	Thickness of Lead, in.	Diameter over Lead, mm.	Diameter over Lead, in.	Lead, Weight, kilog. per km.	Lead, Price, shillings per km.	Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price in shillings per km.	Price in shillings per 1000 yards	Price in shillings per statute mile
For Mesh or Star point unearthed working.																																									
0·025	16·13	7	0·067	1·71	5·1	144	184	0·13	0·13	8·4	0·331	39	16	31	12	15·7	0·618	642	636	6	6	19·0	0·748	50	20	40	16	2·05	0·08	23·1	0·909	1541	370	2279	1048	26	150	150	1374	1256	2211
·050	32·26	19	·058	1·47	7·4	287	367	·13	·13	10·7	·421	52	21	42	17	20·0	0·787	1143	1215	11	12	23·3	0·917	62	25	50	20	2·3	·09	27·9	1·10	2103	505	3369	1777	44	180	270	2271	2077	3655
·075	48·4	19	·071	1·80	9·0	431	552	·13	·13	12·3	·484	61	24	49	20	22·9	0·902	1623	1788	16	18	26·2	1·03	70	28	56	22	2·55	·10	31·3	1·23	2618	628	4383	2484	62	212	318	3076	2813	4950
·100	64·5	19	·082	2·08	10·4	575	736	·14	·14	14·0	·551	76	30	61	24	26·1	1·03	2136	2370	21	24	29·7	1·17	87	35	70	28	2·8	·11	35·3	1·39	3252	780	5566	3237	81	245	430	3993	3651	6425
·125	80·6	19	·091	2·32	11·6	718	919	·14	·14	15·2	·598	83	33	66	26	28·2	1·11	2601	2934	26	29	31·9	1·26	94	38	75	30	2·8	·11	37·5	1·48	3471	833	6267	3864	97	278	487	4726	4321	760
·150	96·8	37	·072	1·83	12·8	862	1103	·14	·14	16·4	·646	91	36	73	29	30·6	1·21	3078	3504	31	35	34·2	1·35	101	40	81	32	3·05	·12	40·3	1·59	4058	974	7349	4585	115	310	543	5553	5078	893
·200	129	37	·083	2·11	14·8	1150	1472	·14	·14	18·4	·724	103	41	82	33	34·3	1·35	4005	4638	40	46	37·9	1·49	112	45	90	36	3·3	·13	44·5	1·75	4858	1166	9105	5931	148	374	748	7201	6584	11590
·250	161	37	·093	2·35	16·5	1436	1838	·15	·15	20·3	·799	121	48	97	39	37·8	1·49	4962	5775	50	58	41·6	1·64	130	52	104	42	3·3	·13	48·2	1·90	5290	1270	10536	7197	180	440	880	8697	7952	1400
For Star point earthed working.																																									
0·025	16·13	7	0·067	1·71	5·1	144	184	0·13	0·10	8·4	0·331	39	16	31	12	15·7	0·618	642	636	6	6	17·5	0·689	52	21	42	17	2·05	0·08	21·6	0·850	1431	343	2173	1023	26	150	150	1349	1234	217
·050	32·26	19	·058	1·47	7·4	287	367	·13	·10	10·7	·421	52	21	42	17	20·0	0·787	1143	1215	11	12	21·8	0·858	65	26	52	21	2·3	·09	26·4	1·04	1979	475	3250	1749	44	180	270	2243	2051	360
·075	48·4	19	·071	1·80	9·0	431	552	·13	·10	12·3	·484	61	24	49	20	22·9	0·902	1623	1788	16	18	24·7	0·972	74	30	59	24	2·55	·10	29·8	1·17	2483	596	4255	2456	61	212	318	3047	2786	49
·100	64·5	19	·082	2·08	10·4	575	736	·14	·11	14·0	·551	76	30	61	24	26·1	1·03	2136	2370	21	24	28·1	1·11	94	38	75	30	2·8	·11	33·7	1·33	3091	742	5417	3204	80	245	430	3959	3620	63
·125	80·6	19	·091	2·32	11·6	718	919	·14	·11	15·2	·598	83	33	66	26	28·2	1·11	2601	2934	26	29	30·3	1·19	101	40	81	32	2·8	·11	35·9	1·41	3311	795	6120	3830	96	278	487	4691	4290	75
·150	96·8	37	·072	1·83	12·8	862	1103	·14	·11	16·4	·646	91	36	73	29	30·6	1·21	3078	3504	31	35	32·6	1·28	109	44	87	35	3·05	·12	38·7	1·52	3882	932	7187	4550	114	310	543	5517	5045	88
·200	129	37	·083	2·11	14·8	1150	1472	·14	·11	18·4	·724	103	41	82	33	34·3	1·35	4005	4638	40	46	36·3	1·43	122	49	98	39	3·3	·13	42·9	1·69	4666	1120	8931	5892	147	374	748	7161	6548	115
·250	161	37	·093	2·35	16·5	1436	1838	·15	·12	20·3	·799	121	48	97	39	37·8	1·49	4962	5775	50	58	40·1	1·58	155	62	124	50	3·3	·13	46·7	1·84	5118	1228	10409	7173	179	440	880	8672	7930	139

TABLE No. 161.—CONSTRUCTION DATA AND PRICES OF THREE-CORE, SECTOR-CONDUCTOR, PAPER INSULATED, LEAD-COVERED CABLE FOR 3300 VOLTS WORKING. Thicknesses according to the Rules of the Cable Makers' Association.

Based on: Copper at £60 per ton; Lead at £1 4s. per 100 kilogrammes; Paper and Impregnating Compound at £2 per 100 kilogrammes.

Area of each Conductor		Number and Diameter of Wires			Diam. over the conductor in mm.	Copper		Paper thickness in in.		Diameter over Paper of Core		Paper		Impregnating Compound		Diameter over the Three Cores		Three Cores laid up		1 per cent. for lay		Diameter over Outer Paper		Paper		Impregnating Compound		Thickness of Lead		Diameter over Lead		Lead		Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price in shillings per	
sq. in.	sq. mm.	No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	Copper to Copper	Copper to Lead	mm.	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.						km.	1000 yards.
FOR MESH OR STAR POINT UNEARTHED WORKING.																																								
0·025	16·13	7	0·067	1·71	5·1	144	184	0·15	0·15	8·9	0·35	46	18	37	15	16·6	0·654	681	651	7	7	20·4	0·803	122	49	98	39	2·3	0·09	25·0	0·984	1861	447	2772	1196	30	205	205	1633	1493
·050	32·26	19	·058	1·47	7·4	287	367	·15	·15	11·2	·441	61	24	49	20	20·9	0·823	1191	1233	12	12	24·7	0·972	150	60	120	48	2·55	·10	29·8	1·17	2483	596	3956	1949	49	250	375	2623	2399
·075	48·4	19	·071	1·80	9·0	431	552	·15	·15	12·8	·504	72	29	58	23	23·9	0·941	1683	1812	17	18	27·7	1·09	170	68	136	54	2·55	·10	32·8	1·29	2754	661	4769	2613	65	300	450	3428	3135
·100	64·5	19	·082	2·08	10·4	575	736	·16	·16	14·5	·571	88	35	70	28	27·0	1·06	2199	2397	22	24	31·1	1·22	206	82	165	66	2·8	·11	36·7	1·45	3391	814	5983	3383	85	355	622	4445	4065
·125	80·6	19	·091	2·32	11·6	718	919	·16	·16	15·7	·618	97	39	78	31	29·3	1·15	2679	2967	27	30	33·4	1·32	222	89	178	71	3·05	·12	39·5	1·56	3972	953	7078	4110	103	400	700	5313	4858
·150	96·8	37	·072	1·83	12·8	862	1103	·16	·16	16·9	·665	105	42	84	34	31·5	1·24	3153	3537	32	35	35·6	1·40	238	95	190	76	3·05	·12	41·7	1·64	4213	1011	7826	4754	119	465	815	6153	5627
·200	129	37	·083	2·11	14·8	1150	1472	·16	·16	18·9	·744	119	48	95	38	35·2	1·39	4092	4674	41	47	39·3	1·55	264	106	211	84	3·3	·13	45·9	1·80	4812	1155	9420	6066	152	550	963	7731	7070
·250	161	37	·093	2·35	16·5	1436	1838	·17	·17	20·8	·819	139	56	111	44	38·8	1·53	5058	5814	51	58	43·1	1·70	305	122	244	98	3·55	·14	50·2	1·98	5917	1420	11575	7512	188	650	1138	9488	8676
FOR STAR POINT EARTHED WORKING.																																								
0·025	16·13	7	0·067	1·71	5·1	144	184	0·15	0·12	8·9	0·35	46	18	37	15	16·6	0·654	681	651	7	7	18·9	0·744	71	28	57	23	2·3	0·09	23·5	0·925	1742	418	2558	1127	28	205	205	1565	1431
·050	32·26	19	·058	1·47	7·4	287	367	·15	·12	11·2	·441	61	24	49	20	20·9	0·823	1191	1233	12	12	23·2	0·913	88	35	70	28	2·55	·10	28·3	1·11	2346	563	3707	1871	47	250	375	2543	2325
·075	48·4	19	·071	1·80	9·0	431	552	·15	·12	12·8	·504	72	29	58	23	23·9	0·941	1683	1812	17	18	26·2	1·03	100	40	80	32	2·55	·10	31·3	1·23	2618	628	4498	2530	63	300	450	3343	3057
·100	64·5	19	·082	2·08	10·4	575	736	·16	·13	14·5	·571	88	35	70	28	27·0	1·06	2199	2397	22	24	29·5	1·16	122	49	98	39	2·8	·11	35·1	1·38	3231	775	5672	3284	82	355	622	4343	3971
·125	80·6	19	·091	2·32	11·6	718	919	·16	·13	15·7	·618	97	39	78	31	29·3	1·15	2679	2967	27	30	31·8	1·25	132	53	106	42	3·05	·12	37·9	1·49	3796	911	6740	4003	100	400	700	5203	4758
·150	96·8	37	·072	1·83	12·8	862	1103	·16	·13	16·9	·665	105	42	84	34	31·5	1·24	3153	3537	32	35	34·0	1·34	142	57	114	46	3·05	·12	40·1	1·58	4035	968	7476	4643	116	465	815	6039	5522
·200	129	37	·083	2·11	14·8	1150	1472	·16	·13	18·9	·744	119	48	95	38	35·2	1·39	4092	4674	41	47	37·7	1·48	158	63	126	50	3·3	·13	44·3	1·74	4830	1159	9247	5993	150	550	963	7656	7002
·250	161	37	·093	2·35	16·5	1436	1838	·17	·14	20·8	·819	139	56	111	44	38·8	1·53	5058	5814	51	58	41·6	1·64	196	78	157	63	3·55	·14	48·7	1·92	5721	1373	11183	7386	185	650	1138	9359	8558

Table No. 102. Construction Data and Prices of Three-Core, Sector-Conductor, Paper Insulated, Lead-covered Cable for [illegible] Volts Working. Thicknesses according to the Rules of the Cable Makers' Association.

Based on: Copper at £60 per ton, Lead at £1 4s per 100 kilogrammes; Paper and Impregnating Compound at £[illegible] per 100 kilogrammes.

Area of Each Conductor		Number and Diameter of Wires			[illegible]	Copper		Paper Thickness [illegible]		[illegible]		Paper		Impregnating Compound		[illegible] over the Three Cores		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		Lead		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
sq. in.	sq. mm.	No.	in.	mm.	mm.	Weight per km.	Price per km.	Copper to Copper	Copper to Lead	mm.	in.	Weight per km.	Price per km.	Weight per km.	Price per km.	mm.	in.	Weight per km.	Price per km.	Weight per km.	Price per km.	mm.	in.	Weight per km.	Price per km.	Weight per km.	Price per km.	mm.	in.	mm.	in.	Weight per km.	Price per km.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
For Mesh or Star Point Unearthed Working.																																									
[illegible]	[illegible]	7	0·087	1·71	5·1	144	184	0·23	[illegible]	10·9	0·429	89	32	64	26	20·3	0·799	861	726	9	7	26·1	1·03	233	93	186	74	2·55	0·10	31·2	1·23	2999	626	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	19	[illegible]	[illegible]	7·4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	19	·071	[illegible]	9·0	431	552	·23	·23	14·8	·587	119	48	95	38	27·6	1·09	1935	1914	19	19	33·4	1·32	306	122	245	98	3·05	·12	39·5	1·56	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	19	·082	2·08	10·4	575	736	·24	·24	16·5	·650	142	57	114	46	30·8	1·21	2493	2517	25	25	36·9	1·45	357	143	286	114	3·05	·12	43·0	1·69	4551	1044	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	19	·091	2·32	11·6	718	919	·24	·24	17·7	·697	154	62	123	49	33·0	1·30	2985	3090	30	31	39·1	1·54	380	152	304	121	3·3	·13	45·7	1·80	5002	1201	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	37	·072	1·83	12·8	862	1103	·24	·24	18·9	·744	167	67	134	54	35·2	1·39	3489	3672	35	37	41·3	1·63	403	161	322	129	3·3	·13	47·9	1·88	5254	1261	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	37	·083	2·11	14·8	1150	1472	·24	·24	20·9	·823	188	75	150	60	39·0	1·54	4464	4821	45	48	45·1	1·78	443	177	354	142	3·55	·14	52·2	2·05	6168	1480	11474	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	37	·093	2·35	16·5	1436	1838	·25	·25	22·8	·898	214	86	171	68	42·5	1·67	5463	5976	55	60	48·8	1·92	497	199	398	159	3·8	·15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
For Star Point Earthed Working.																																									
[illegible]	[illegible]	7	0·087	1·71	5·1	144	184	0·23	0·17	10·9	0·429	89	32	64	26	20·3	0·799	864	726	9	7	23·1	0·909	105	42	84	34	2·55	0·10	28·2	1·11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	19	[illegible]	[illegible]	7·4	[illegible]	[illegible]	·23	·17	13·2	·520	103	41	82	33	24·6	0·969	1416	1323	14	13	27·4	1·08	126	50	101	40	2·8	·11	33·0	1·30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	19	[illegible]	[illegible]	9·0	431	552	·23	·17	14·8	·587	119	48	95	38	27·6	1·09	1935	1914	19	19	30·4	1·20	140	56	112	45	3·05	·12	36·5	1·44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	736	·24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	43·7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	·744	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	37	[illegible]	[illegible]	16·5	1436	1838	·25	·19	22·8	·898	214	86	171	68	42·5	1·67	5463	5976	55	60	45·8	1·80	252	101	202	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE No. 163.—CONSTRUCTION DATA AND PRICES OF THREE-CORE, PAPER INSULATED, LEAD-COVERED CABLE FOR 11,000 VOLTS WORKING. Thicknesses according to the Rules of the Cable Makers' Association.

Based on: Copper at £60 per ton; Lead at £1 4*s*. per 100 kilogrammes; Manila Paper at £4 per 100 kilogrammes; Impregnating Compound at £2 per 100 kilogrammes.

(*Note.*—Up to and including the 0·125 sq. inch the conductors are circular; above that size they are sector-shaped.)

Area of each Conductor		Number and Diameter of Wires			Diam. over Conductor, mm.	Copper		Paper, thickness in in.		Diameter over Paper Core		Paper		Impregnating Compound		Diameter over the Three Cores		Three Cores laid up		1 per cent. for lay		Diameter over Outer Paper		Paper		Impregnating Compound		Thickness of Lead		Diameter over Lead		Lead		Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price in shillings per		
sq. in.	sq. mm.	No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	Copper to Copper	Copper to Lead	mm.	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	Weight, kilog. per km	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km	mm	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	mm.	in.	Weight, kilog per km.	Price, shillings per km.						km	1000 yards	statute mile
FOR MESH OR STAR POINT UNEARTHED WORKING.																																									
0·025	16·13	7	0·067	1·71	5·1	144	184	0·35	0·35	14·0	0·551	147	118	118	47	30·2	1·19	1227	1047	12	10	39·1	1·54	533	426	426	170	3·05	0·12	45·2	1·78	4596	1103	6794	2756	55	395	395	3601	3293	5795
·050	32·26	19	·058	1·47	7·4	287	367	·35	·35	16·3	·642	182	146	146	58	35·1	1·38	1845	1713	18	17	44·0	1·73	608	486	486	194	3·30	·13	50·6	1·99	5577	1339	8534	3749	75	455	682	4961	4537	7984
·075	48·4	19	·071	1·80	9·0	431	552	·35	·35	17·9	·705	207	166	166	66	38·6	1·52	2412	2352	24	24	47·5	1·87	662	530	530	212	3·30	·13	54·1	2·13	5988	1437	9616	4555	91	505	757	5908	5403	9507
·100	64·5	19	·082	2·08	10·4	575	736	·36	·36	19·5	·768	235	188	188	75	42·0	1·65	2994	2997	30	30	51·1	2·01	732	586	586	234	3·55	·14	58·2	2·29	6930	1663	11272	5510	110	560	980	7160	6548	11523
·125	80·6	19	·091	2·32	11·6	718	919	·36	·36	20·7	·815	254	203	203	81	44·6	1·76	3525	3609	35	36	53·7	2·11	773	618	618	247	3·55	·14	60·8	2·39	7260	1742	12211	6252	125	615	1076	8068	7378	12985
·150	96·8	37	·072	1·83	12·8	862	1103	·36	·36	21·9	·862	273	218	218	87	40·8	1·61	4059	4224	41	42	49·9	1·97	713	570	570	228	3·80	·15	57·5	2·26	7289	1749	12672	6813	136	670	1132	8751	8002	14083
·200	129·0	37	·083	2·11	14·8	1150	1472	·36	·36	23·9	·941	304	243	243	97	46·2	1·82	5091	5436	51	54	55·3	2·18	798	638	638	255	4·05	·16	63·4	2·50	8587	2061	15165	8444	169	770	1347	9730	8898	15660
·250	161·2	37	·093	2·35	16·5	1436	1838	·37	·37	25·9	1·02	344	275	275	110	48·3	1·90	6165	6669	62	67	57·7	2·27	861	688	688	275	4·3	·17	66·3	2·61	9524	2286	17300	9985	200	880	1540	12605	11530	20280
FOR STAR POINT EARTHED WORKING.																																									
0·025	16·13	7	0·067	1·71	5·1	144	184	0·35	0·23	14·0	0·551	147	118	118	47	30·2	1·19	1227	1047	12	10	33·0	1·30	153	122	122	49	3·05	0·12	39·1	1·54	3924	942	5438	2170	43	395	395	3003	2746	4832
·050	32·26	19	·058	1·47	7·4	287	367	·35	·23	16·3	·642	182	146	146	58	35·1	1·38	1845	1713	18	17	37·9	1·49	176	141	141	56	3·30	·13	44·5	1·75	4858	1166	7038	3093	62	455	682	4292	3925	6906
·075	48·4	19	·071	1·80	9·0	431	552	·35	·23	17·9	·705	207	166	166	66	38·6	1·52	2412	2352	24	24	41·4	1·63	194	155	155	62	3·30	·13	48·0	1·89	5268	1265	8053	3858	77	505	757	5197	4752	8362
·100	64·5	19	·082	2·08	10·4	575	736	·36	·24	19·5	·768	235	188	188	75	42·0	1·65	2994	2997	30	30	45·1	1·78	233	186	186	74	3·55	·14	52·2	2·06	6168	1480	9611	4767	95	560	980	6402	5854	10304
·125	80·6	19	·091	2·32	11·6	718	919	·36	·24	20·7	·815	254	203	203	81	44·6	1·76	3525	3609	35	36	47·7	1·88	247	198	198	79	3·55	·14	54·8	2·16	6500	1560	10505	5482	110	615	1076	7283	6660	11720
150	96·8	37	·072	1·83	12·8	862	1103	·36	·24	21·9	·862	273	218	218	87	40·8	1·61	4059	4224	41	42	43·9	1·73	227	182	182	73	3·80	·15	51·5	2·03	6480	1555	10989	6076	122	670	1132	8000	7316	12880
200	129·0	37	·083	2·11	14·8	1150	1472	·36	·24	23·9	941	304	243	243	97	46·2	1·82	5091	5436	51	54	49·3	1·94	256	205	205	82	4·05	·16	57·4	2·26	7718	1852	13321	7629	153	770	1347	9899	9052	15930
250	161·2	37	·093	2·35	16·5	1436	1838	·37	·25	25·9	1·02	344	275	275	110	48·3	1·90	6165	6669	62	67	51·6	2·03	285	228	228	91	4·30	·17	60·2	2·37	8585	2060	15325	9115	182	880	1540	11717	10715	18850

Table No. 164.—Construction Data and Prices of Three-Core, Paper Insulated, Lead-covered Cables for 20,000 Volts Working.

Based on: Copper at £60 per ton; Lead at £1 4*s*. per 100 kilogrammes; Manila Paper at £4 per 100 kilogrammes; Impregnating Compound at £2 per 100 kilogrammes.

Area of each Conductor		Number and Diameter of Wires			Diam. over Conductor, mm.	Copper		Paper thickness, Cu to Cu and Cu to Pb		Diameter over Insulated Core		Paper		Impregnating Compound		Diameter over the Three Cores		Three Cores laid up		1 per cent. for lay		Diameter over Outside Paper		Paper		Impregnating Compound		Lead Thickness		Diameter over Lead		Lead		Total Weight of Material, kilog. per km.	Total Price of Material, shillings per km.	Waste, shillings per km.	Wages, shillings per km.	Shop Expenses, shillings per km.	Price in shillings per		
sq. in.	sq. mm.	No.	in.	mm.		Weight, kilog. per km.	Price, shillings per km.	in.	mm.	in.	mm.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.	Weight, kilog. per km.	Price, shillings per km.	mm.	in.	mm.	in.	Weight, kilog. per km.	Price, shillings per km.						km.	1000 yards	statute mile
For Mesh or Star point unearthed working.																																									
0·025	16·13	7	0·067	1·71	5·1	144	184	0·638	16·2	0·839	21·3	370	296	296	118	45·9	1·81	2430	1794	24	18	62·1	2·45	1512	1210	1210	484	4·3	0·17	70·7	2·78	10199	2448	15375	5954	119	770	770	7613	6961	12250
·050	32·26	19	·058	1·47	7·4	287	367	·638	16·2	0·929	23·6	434	347	347	139	50·9	2·00	3204	2559	32	26	67·1	2·64	1652	1322	1322	529	4·3	·17	75·7	2·98	10966	2632	17176	7068	141	850	1275	9334	8534	15020
·075	48·4	19	·071	1·80	9·0	431	552	·638	16·2	0·992	25·2	479	383	383	153	54·3	2·14	3879	3264	39	33	70·5	2·78	1747	1398	1398	559	4·3	·17	79·1	3·12	11489	2757	18552	8011	160	900	1350	10421	9528	16770
·100	64·5	19	·082	2·08	10·4	575	736	·650	16·5	1·06	26·9	532	426	426	170	58·0	2·28	4599	3996	46	40	74·5	2·93	1889	1511	1511	604	4·6	·18	83·7	3·30	12997	3119	21042	9270	185	975	1706	12136	11109	19530
·125	80·6	19	·091	2·32	11·6	718	919	·650	16·5	1·11	28·1	566	453	453	181	60·6	2·39	5311	4659	53	47	77·1	3·04	1963	1570	1570	628	4·6	·18	86·3	3·40	13425	3222	22322	10126	203	1050	1857	13236	12100	21300

INDEX.

INDEX TO TABLES OF CONSTRUCTIONAL DATA.

(The numbers refer to the tables, and not to the pages.)

Dielectric Material	Size of Conductor expressed in	Working Pressure in Volts	Type of Cable — Single	Concentric	2 Core	Triple Concentric	3 Core
Paper	sq. in.	600	134 : 152	145 : 146 : 153	..	151 : 154	155
”	”	700	136	147	..	..	..
”	”	1000	..	148 : 149	..	..	..
”	”	2000	..	156	..	..	160
”	”	3000	..	157	..	..	161
”	”	6000	..	158	..	..	162
”	”	11000	..	159	..	..	163
”	”	20000	..	..	..	..	164
”	sq. mm.	600	133	..	..	..	..
”	”	1000	135	..	..	..	..
”	”	3000	137	..	..	..	..
”	L.S.W.G.	600	138 : 139	..	..	..	..
”	”	700	140 : 141	..	..	150	..
”	”	1000	142 : 143 : 144	..	..	..	..
Paper and Jute	sq. m.m.	600	..	..	166	..	170
”	”	1000	..	..	167	..	171
”	”	2000	..	..	168	..	172
”	”	3000	..	..	169	..	173
”	”	6000	..	..	..	..	174
”	”	10000	..	..	..	..	175
Jute	”	500	176	..	..	..	..
”	”	600	177	..	..	..	182
”	”	700	178	184	..	188	..
”	”	1000	179	185	181	..	183
”	”	2000	..	186	181	..	183
”	”	3000	180	187	181	..	183

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Dielectric Material	Size of Conductor expressed in	Working Pressure in Volts	Grade	Number of Table
Rubber	L.S.W.G.	..	300/600 Ω	190
,,	,,	..	2500 Ω	191
,,	sq. mm.	500	..	192
,,	,,	1000	..	193 : 194
,,	,,	2000	..	194
,,	,,	3000	..	197
,,	L.S.W.G.	1000	..	195
,,	,,	2000	..	195 : 196
,,	,,	3000	..	199
Jute	..	Telegraph	..	189
Paper	..	Telephone	..	198

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